

⑥

EUROPEAN PATENT APPLICATION

① Application number: 87116861.3

⑤ Int. Cl.⁴ G01N 1/10, G01N 35/00,
G01F 11/02

② Date of filing: 16.11.87

③ Priority: 17.11.86 US 931476

④ Date of publication of application:
25.05.88 Bulletin 88/21

⑥ Designated Contracting States:
AT BE CH DE ES FR GB GR IT LI LU NL SE

⑦ Applicant: ABBOTT LABORATORIES

Abbott Park Illinois 60064(US)

⑧ Inventor: Hayes, Donald J.

2012 Tampico Drive
Plano Texas 75075(US)

Inventor: Wallace, David B.
9929 Wood Forest
Dallas Texas 75243(US)

Inventor: Verlee, Donald J.

663 Drake Street
Libertyville Illinois 60048(US)

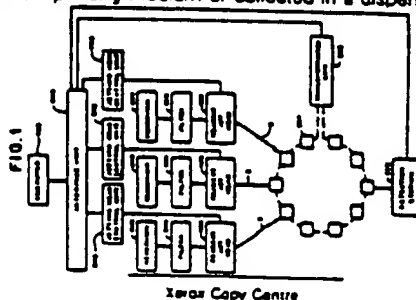
Inventor: Houseman, Kenneth R.

1520 S. Main Street
Racine Wisconsin 53403(US)

⑨ Representative: Modiano, Guido et al
MODIANO, JOSIF, PISANTY & STAUB
Modiano & Associati Via Maravigli, 16
I-20123 Milan(IT)

⑩ Apparatus and process for reagent fluid dispensing and printing.

⑪ A system for printing and dispensing chemical reagents in precisely controlled volumes onto a medium at a precisely controlled location. A jetting tube, comprising an orifice at one end and a fluid receiving aperture at the other end, is concentrically mounted within a cylindrical piezo-electric transducer. The fluid receiving aperture is connected to a reservoir containing a selected reagent by means of a filter. The reservoir is pressurized by a regulated air supply. An electrical signal of short duration is applied to the transducer. The pulse causes the transducer and the volume defined by the jetting tube to expand, thereby drawing in a small quantity of reagent fluid. The cessation of the pulse causes the transducer and the volume of the jetting tube to de-expand, thereby causing at least a substantially uniformly sized droplet of reagent fluid to be propelled through the orifice. The droplet may be directed to impact a printing medium or collected in a dispensing receptacle.



EP 0 268 237 A2

count down inputs CU, CD of the counter U24 by means of opto-isolators U19, U20. The carry and borrow outputs CY, BR of the counter U24 are connected with the count up and count down inputs CU, CD of the counter U25. The reset inputs RST of both counters U24, U25 receive the RST signal by means of an opto-isolator U21. Resistors R16, R17, R18 are used as load resistors for the LED circuits of the isolators U19, U20, U21 and capacitors C26, C27, C28 are used to enhance the stability of the isolator circuits.

The counters U24, U25 may optionally be preloaded to the selected 8-bit binary value through input lines TP0-TP7. The input lines TP0-TP7 are normally biased to the logical high signal state by resistive network U22. The selected binary value is loaded into the counters U24, U25 by pulling the respective inputs TP0-TP7 low and applying an external, active low, load signal EXT LOAD to pin TP8. The load signal pin TP8 is connected to the load inputs LOAD of the counters U24, U25 and conditioned by a clipping circuit comprised of diodes CR8, CR10 and a pull-up resistor of the resistor network U22.

The noninverted and the inverted outputs IOUT, IOU \bar{T} are connected to the inverting and noninverting inputs of a differential amplifier U29. The output of the amplifier U29 is fed back to the inverting input by a resistor R50. The amplifier U29 converts the current output of the D/A converter U30 to a voltage output. Capacitors C56, C47 are provided to enhance circuit stability.

The output of the amplifier U29 is applied to the noninverting input of the amplifier U28. The output of the amplifier U28 is fed back to the inverting input by means of a capacitor C46 and a resistor R37. The inverting input is also connected to ground by a resistor R36. To enhance the frequency response of the amplifier U28, a resistor R43 and a capacitor C54 are connected between the frequency compensation input FC and ground. An adjustable DC offset is provided by connecting the output offset inputs OF, OF with a variable resistor R42. The wiper of the resistor R42 is connected to the high voltage power supply output V $_{+}$.

The output of the amplifier U28 is also connected to the base of a transistor Q4 and through diodes CR11, CR12 to the base of a transistor Q7. The transistor Q4, Q7, Q3 and resistors R30-R35 form an output circuit capable of driving high capacitive loads at high slew rates and wide bandwidth. The variable resistor R31 may be used to set the maximum current through the bias network R30, R33 by measuring the voltage drop across resistor R35.

The strobe generator 580 produces a strobe pulse and comprises transistors Q101-Q105 and a one-shot circuit U108. The strobe intensity is determined by the circuit comprising the transistors Q101-Q104 and resistors R109-R115. The circuit is connected to the anode of the LED 900 and receives two inputs from the interface unit 600 to produce four levels of light intensity in the LED 900.

The activation and duration of activation of the LED 900 is determined by the one-shot U108 and the transistor Q105. The one-shot U108 comprises inputs A, B and an output Q. The strobe signal STROBE is applied to the B input from the interface unit 600. The duration of the one-shot U108 output pulse is controlled by the adjustable RC network R107, R108. The output Q is applied to the base of the transistor Q105 by resistor R108. The collector of the transistor Q105 is connected to the cathode of the LED 900 to draw current through the LED 900.

The computer 700, control unit 500 and plotter 800 must be initialized. The initialization of the computer 700 and the plotter 800 will not be discussed since these units are of conventional design and operation.

To initialize the jetting head control unit 500, the computer 700 directs the interface unit 600 to issue a reset command. The reset signal RST is conducted to the control unit 500 whereupon the counters U24, U25 are cleared. The computer 700 then retrieves from its memory, or by conventional operator input, the desired digital setting for the D/A converter. This setting may also be calculated from data and may be tailored to specific sizes of jetting heads 400 or reagent fluids. The computer 700 then issues a series of commands, through the interface unit 600, to increment or decrement the counters U24, U25 to correspond to the desired binary setting. If the command directs that the counters are to be raised, then the HIGHER signal is applied through the opto-isolator U20 to the count up CU input of the counter U24. Similarly, if the command directs that the counters are to be lowered then the LOWER signal is applied through the opto-isolator U19 to the count down CD input of the counter U24. Since the carry and borrow outputs CY, BR of the counter U24 are connected to the count up and count down inputs CU, CD, respectively, of the counter U25, the digital setting applied to the D/A converter U30 may range from 0 to 255. Alternately, the counters U24, U25 could be initialized to a desired setting by loading the binary value on the lines TP0-TP7 and strobing the EXT LOAD line.

Once the control unit 500 and the plotter 800 are initialized, the printing cycle may begin. The computer 700 issues a command to the interface unit 600 to produce the series of PRT signal pulses. The computer 700 then commands the plotter 800 to print, for example, a line along a selected path. The plotter 800 positions the jetting head 400 and target 1 and issues the pen down signal PENDN. The signal is delayed by the print control circuit 510 to ensure that the target 1 is properly positioned. At the expiration of the

APPARATUS AND PROCESS FOR REAGENT FLUID DISPENSING AND PRINTING

BACKGROUND OF THE INVENTION

The present invention relates to an apparatus and process for dispensing and printing reagent fluids, wherein a transducer is used to propel small quantities of the fluid towards a positioned target.

Diagnostic assays often require systems for metering, dispensing and printing reagent fluids. In the case of metering and dispensing, such systems comprise both manual and automatic means. For purposes of practicality, the present background discussion will focus on the methods of metering and dispensing 100 micro-liter volumes or less.

The manual systems of metering and dispensing include the glass capillary pipet; the micro-pipet; the precision syringe; and weighing instruments. The glass capillary pipet is formed from a precision bore glass capillary tube. The pipet typically comprises a fire blown bulb and a tubular portion fine drawn to a fine point. Fluid is precisely metered by aspirating liquid through the tube into the bulb to a predetermined level indicated by an etched mark. The fluid may then be dispensed by blowing air through the tube.

The micro-pipet typically comprises a cylinder and a spring loaded piston. The travel of the piston is precisely determined by a threaded stop. The distance the piston travels within the cylinder and the diameter of the cylinder define a precise volume. The fluid is aspirated into and dispensed from the micro-pipet in precise quantities by movement of the piston within the cylinder.

The precision syringe generally comprises a precisely manufactured plunger and cylinder with accurately positioned metering marks. The fluid is introduced into and dispensed from the syringe by movement of the plunger between the marks.

Weighing techniques for dispensing fluids often simply involve weighing a quantity of fluid. The density of the fluid may then be used to determine the fluid volume.

Exemplary automatic metering and dispensing systems include the precision syringe pump; the peristaltic pump; and the high performance liquid chromatography (HPLC) metering valve. The precision syringe pump generally comprises a precision ground piston located within a precision bore cylinder. The piston is moved within the cylinder in precise increments by a stepping motor.

The peristaltic pump comprises an elastomeric tube which is sequentially pinched by a series of rollers. Often the tube is placed inside a semi-circular channel and the rollers mounted on the outer edge of a disc driven by a stepping motor. The movement of the rollers against the tubing produces peristaltic movement of the fluid.

The HPLC metering valve comprises a defined length of precision inner diameter tubing. The fluid is introduced into the defined volume of the tubing with the valve in a first position and then dispensed from the tubing when the valve is placed in a second position.

All of the above metering and dispensing systems have the disadvantage that the volumes dispensed are relatively large. Furthermore, these systems are also relatively slow, inefficient and comprise precision fitted components which are particularly susceptible to wear.

The printing of reagent fluids is frequently required in the manufacture of chemical assay test strips. Selected reagents are printed in a desired configuration on strips of filter paper. The strips may then be used as a disposable diagnostic tool to determine the presence or absence of a variety of chemical components.

Generally, to perform a chemical assay with a test strip, the strip is exposed to a fluid or a series of fluids to be tested, such as blood, serum or urine. In some instances, the strip is rinsed and processed with additional reagents prior to being interpreted. The precise interpretation depends on the type of chemical reactions involved, but it may be as simple as visually inspecting the test strip for a particular color change.

The manufacture of test strips generally involves either a manufacturing process or a blotting process. The blotting process is the simplest manufacturing method and permits most reagents to be applied without modification. A disadvantage of this process is that it is difficult to blot the fluids onto the test strip with precision.

The printing process will often involve any of three well known methods: silk screening; gravure; and transfer printing. The silk screening of reagents generally involves producing a screen by photographic methods in the desired configuration for each reagent to be printed. The screen is exposed under light to a preselected pattern and then developed. The areas of the screen which are not exposed to light, when developed, become porous. However, the areas of the screen which have been exposed to light remain relatively nonporous. The screen is then secured in a frame and the test strip placed below. The desired

reagent fluid, specially prepared to have a high viscosity, is spread over the top side of the screen. The reagent passes through the porous areas of the screen and onto the test strip. The test strip is then subjected to a drying process, specific to each reagent. Once the test strip is dry, it may be printed again using a different screen, pattern and reagent.

5 The gravure method of printing reagents comprises coating a metal surface with a light sensitive polymer. The polymer is exposed to light in the desired predetermined pattern. When developed, the polymer creates hydrophilic and hydrophobic regions. The reagent is specially prepared such that when applied to the metal it will adhere only to the hydrophilic regions. After the specially prepared reagent is applied, the test strip is pressed against the metal and the reagent is transferred from the metal to the test strip.

10 The transfer printing method comprises transferring the reagents from a die to the test strip in the desired pattern. The die is made with the appropriate pattern on its surface and then coated with the desired, specially prepared reagent. A rubber stamp mechanism is pressed against the die to transfer the reagent in the desired pattern from the die to the rubber stamp. The rubber stamp is then pressed against the test strip to transfer the reagent, in the same pattern, to the test strip.

15 Each of the above-mentioned reagent printing techniques has significant disadvantages. The most common disadvantage is the requirement that the reagents must be specially prepared. Additionally, if a variety of reagents are to be printed onto a single test strip, the strip must be carefully aligned prior to each printing. This alignment procedure increases the cost and decreases the throughput of the printing process. Moreover, a special die or screen must be produced for each pattern to be printed. A further disadvantage arises in that the above printing methods are unable to place reproducible minute quantities of reagent on the test strip.

20 It is an object of the present invention to provide a printing and dispensing method and apparatus which avoids these disadvantages.

25

SUMMARY OF THE PRESENT INVENTION

The present invention is directed to a reagent dispensing and printing apparatus and method, wherein the apparatus comprises a transducer operative to eject a substantially uniform quantity of reagent in a precise predetermined direction.

According to one preferred embodiment of the present invention used in dispensing reagent fluids, a jetting tube is concentrically located with a piezoelectric transducer. The jetting tube comprises an orifice at one end and a reagent receiving aperture at the other end. The receiving end of the jetting tube is connected to a filter which is in turn connected to a reservoir containing a selected reagent. A jetting control unit supplies an electrical pulse of short duration to the transducer in response to a command issued by a computer. The electrical pulse causes the volume defined by the jetting tube to expand by an amount sufficient to intake a small quantity of reagent fluid from the reservoir. At the end of the pulse duration, the transducer de-expands propelling a small quantity of the reagent fluid through the orifice and into a fluid receptacle. If desired, additional droplets may be deposited in the receptacle or the receptacle aligned with an additional jetting tube for receiving an additional reagent fluid.

40 An additional preferred embodiment of the present invention may be used for printing reagent fluids onto a print medium. In this embodiment, the jetting tube is aligned with the printing medium such that the propelled droplet impacts a precise position on the medium. The jetting tube or print medium may then be repositioned and another droplet expelled from the jetting tube. The process may be repeated until a desired configuration of the reagent fluid is printed on the medium.

45 One advantage of the present invention is that precise minute quantities of reagent fluid may be dispensed or printed in a reproducible manner. Additionally, the method and apparatus may be used to emit droplets of fluids having a wide range of reagent fluid viscosities and surface tensions. The reagents do not in general have to be specially adapted for use with the present invention.

50 The invention itself, together with further objects and attendant advantages, will best be understood by reference to the following detailed description, taken in conjunction with the accompanying drawings.

55

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a schematic representation of a first preferred embodiment of the present invention showing the use of multiple jetting heads to meter and dispense reagent fluid.

FIGURE 2a is a perspective view of a first preferred embodiment of the jetting head of the present invention.

FIGURE 2b is a cut-away perspective view of the preferred embodiment of Fig. 2a taken along lines 2b-2b with the contact pins removed.

FIGURE 2c is a sectional representation of the preferred embodiment of Fig. 2a taken along lines 2c-

2c. FIGURE 2d is a sectional representation of the preferred embodiment of Fig. 2c taken along lines 2d-2d.

FIGURE 2e is a sectional representation of the jetting tube and transducer of the preferred embodiment of Fig. 2b taken along lines 2e-2e.

FIGURE 3 is a schematic representation of a second preferred embodiment operating in the drop on demand mode as a reagent printing system.

FIGURE 4 is a schematic representation of a third preferred embodiment operating in the continuous mode as a reagent printing system.

FIGURE 5a is a schematic representation of a portion of the jetting head control unit showing the LED strobe circuit.

FIGURE 5b is a schematic representation of a portion of the jetting head control unit showing the high voltage power supply circuit.

FIGURE 5c is a schematic representation of a portion of the jetting head control unit showing the print control circuit.

FIGURE 5d is a schematic representation of a portion of the jetting head control unit showing a portion of the print pulse generator.

FIGURE 5e is a schematic representation of a portion of the jetting head control unit showing an additional portion of the pulse generator.

FIGURE 6a is a perspective view of a second preferred embodiment of the jetting head of the present invention.

FIGURE 6b is an exploded view of the preferred embodiment of Fig. 6a.

FIGURE 7 is a sectional representation of a third preferred embodiment of the jetting head of the present invention.

FIGURE 8 is a sectional view of a symmetrical portion of a fourth preferred embodiment of the jetting head of the present invention.

FIGURE 9 is a graph of the drop mass of the emitted droplets as a function of emission frequency for several fluid viscosities.

FIGURE 10 is a graph of the velocity of the emitted droplets as a function of frequency for several fluid viscosities.

FIGURE 11 is a graph of the total weight of fluid emitted as a function of the number of emitted droplets for a given fluid.

DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENTS

Turning now to the drawings, Fig. 1 shows a schematic representation of a first preferred embodiment of a reagent dispensing system generally represented as reference numeral 30. The dispensing system 30 comprises a plurality of reagent fluid reservoirs 200, a plurality of filters 300, a plurality of reagent jetting heads 400, a plurality of jetting head control units 500, an interface unit 600, a computer 700, transportation unit 902, a plurality of fluid mixing cells 904 and a detection station 906.

The reservoir 200 holds a selected quantity of reagent fluid for dispensing. The reservoir 200 is maintained at atmospheric pressure by suitable means such as an atmospheric vent. The reagent fluid is transferred from the reservoir 200 through the filter 300 to the reagent jetting head 400. The filter 300 is placed between the reservoir 200 and the jetting head 400 to ensure that any particular foreign matter in the reagent fluid is trapped before entering the jetting head 400.

The plurality of jetting heads 400 and the detection station 906 define a processing path. Each jetting head 400, which is described in detail below, ejects uniformly sized droplets 2 of reagent fluid. The droplets 2 are propelled, with controlled velocity and direction, towards a selecting mixing cell 904 positioned along

the processing path by the transportation unit 902. The mixing cells 901 are comprised of non-reactive material and function as minute holding tanks for the dispensed reagent fluid.

The plurality of jetting heads 400, shown in Fig. 1, are positioned sequentially along the processing path. Alternately, some or all of the plurality of jetting heads 400 may be positioned with respect to the transportation unit 902 such that the heads 400 direct the droplets 2 into a selected mixing cell 902 simultaneously.

The jetting heads 400 and the transportation unit 902 are controlled by the computer 700. The computer 700 issues commands to an interface unit 600 which is electrically connected to the transportation unit 902 and to the jetting head control unit 500. The interface unit 600 is of conventional design and is used to control the transfer of information between the computer 700 and the jetting control unit 500. The interface unit 600 is also used to control the transfer of information between the computer 700 and the transportation unit 902.

A first embodiment of the reagent jetting head is shown in Figs. 2a - 2e and generally represented by numeral 400. The jetting head 400 comprises a two piece symmetrical housing 402, 404. The housing 402, 404, when assembled, is adapted to form an orifice aperture 406, an air vent and reagent supply channel 410 and a transducer chamber 403, shown in Fig. 4b. Four screws 408, adapted to respective housing screw apertures 416, hold the housing 402, 404 in an assembled configuration.

The jetting head 400 further comprises a jetting tube 432, a piezo-electric transducer 434 and a reagent fluid supply tube 430. The jetting tube 432 defines a tapered orifice 433 at one end and a fluid receiving aperture 431 at the other end for expelling and receiving fluid, respectively. The piezo-electric transducer 434 is cylindrically shaped and secured concentrically about the mid-region of the jetting tube 432 with epoxy or other suitable means.

The piezo-electric transducer 434, shown in Fig. 2e, defines a first and second end and comprises a section of cylindrically shaped piezo-electric material 435. An inner nickel electrode 437 covers the inner surface of the cylinder 435. The electrode 437 wraps around the first end of the cylinder 435 a sufficient distance to enable electrical connection external to the cylinder 435.

A second nickel electrode 436 covers the majority of the outer surface of the cylinder 435. The second electrode is electrically isolated from the first electrode 437 by an air gap at the face of the second end of the cylinder 435 and by an air gap on the outer surface of the cylinder 435 near the first end. When an electrical pulse is applied to the first and second electrodes 437, 436 a voltage potential is developed radially across the transducer material 435. The voltage potential causes the radial dimensions of the transducer 435 to change, which causes the volume defined by the transducer 434 to also change.

The jetting tube 432 is positioned in the transducer chamber 403 such that the receiving end 431 extends beyond the rearward end of the transducer 434. The receiving end 431 of the jetting tube 432 is inserted into one end of a reagent supply tube 430. The supply tube 430 is sealingly held to the jetting tube 432 by concentric teeth 412 formed by the housing sections 402, 404. The teeth 412 not only seal the supply tube 430 to the jetting tube 432, but, also, seal the supply tube 430 to the housing 402, 404.

The second end of the supply tube 430 passes through the channel 410 and into a reagent reservoir 200. The reservoir 200 contains the reagent fluid to be dispensed by the jetting head 400. As the reagent fluid is dispensed, air is supplied to the reservoir 200 through the channel 410 to prevent the creation of a vacuum in the reservoir 200. The reservoir 200 is releasably attached to the housing 402, 404 and held in place by frictional forces. A reservoir cap 202 is flexibly attached to the reservoir 200 and adapted such that the cap 202 may be used to secure the opening in the reservoir 200 when the reservoir 200 is disengaged from the housing 402, 404.

The position of the jetting tube 432 defines the horizontal plane of the jetting head 400. The jetting tube 432 and the transducer 434 are held in a pre-defined vertical relationship with respect to the housing 402, 404 by means of two upper vertical alignment pins 418 and two lower vertical alignment pins 418. The two upper vertical alignment pins 418 extend horizontally from the housing section 402 into the transducer chamber 403. Similarly, the two lower vertical alignment pins 418 extend horizontally from the housing section 404 into the transducer chamber 403. Each vertical alignment pin 418 is formed integrally with the respective housing sections 402, 404.

The jetting tube 432 and the transducer 434 are held in a predefined horizontal relationship with respect to the housing 402, 404 by means of four horizontal alignment pins 424. Two of the horizontal alignment pins 424 extend horizontally from the housing section 402 approximately midway into the transducer chamber 403. Similarly, two of the horizontal alignment pins 424 extend horizontally from the housing section 404 approximately midway into the transducing chamber 403. Each horizontal alignment pin 424 is formed integrally with the respective housing section 402, 404. The alignment pins 418, 424, sealing teeth 412 and orifice aperture 406 are aligned and adapted to hold the jetting tube 432 and transducer 434 such

that the orifice 433 of the jetting tube 432 extends into the orifice aperture 428.

An electrical transducer activation pulse is supplied to the piezo-electric transducer 434 from the jetting head control unit 500 by means of two contact pins 422. A quantity of fluid will be dispensed from the jetting tube for each applied activation pulse. The activation pulse can be produced by a variety of conventional circuits or commercially available units. Therefore a detailed description of such a circuit will not be provided. However, a circuit for producing a series of activation pulses is provided in the description of the printing embodiment below. Due to the differing constraints involved in dispensing and printing, the circuit in the printing embodiment is not required to produce only a single pulse. However, one skilled in the art could, if desired, modify the circuit to produce a single pulse on demand for use in the dispensing embodiment.

Each contact pin 422 defines an enlarged head 423 which is adapted to contact the respective first and second electrodes 437, 438 located on the outer surface of the transducer 434. Two contact pin holders 414, integral with the housing 402, 404, are positioned to hold the respective contact pins 422 under the pin heads 423 such that each pin head 423 electrically engages the appropriate electrode 437, 438 of the transducer 434. Two contact pin engaging posts 420 extend from the housing 402, 404 opposite the contact pin holders 414 to engage and hold the contact pins 422 against the contact pin holders 414. The ends of the contact pins 422 opposite the pin heads 423 extend through the housing 402, 404 by means of contact pin apertures 421. Since the housing sections 402, 404 are formed symmetrically to one another, the contact pins 422 may be optionally attached above the transducer 434.

In operation, the reservoir 200 containing reagent fluid is fastened to the jetting head 400 such that the fluid supply tube 430 extends into the reagent fluid. The filter 300 may be fitted to the free end of the supply tube 430 or positioned inside the reservoir 200. Air is supplied through the channel 410 around the supply tube 430 to prevent the reservoir 200 from falling below atmospheric pressure. The air is prevented from entering around the supply tube 430 and into the transducer chamber 403 by the seal created between the sealing teeth 412 and the supply tube 430. The jetting tube 432 may be primed by slightly pressurizing the reservoir 200 to cause the reagent fluid to travel through the supply tube 430 and into the jetting tube 432. Once primed, the fluid is prevented from substantially withdrawing from the jetting tube 432 by the surface tension of the reagent fluid at the orifice 433.

The transducer activation pulse is conducted to the contact pins 422 of the jetting head 400. The contact pins 422 communicate the high voltage pulse to the electrodes 437, 438 of the transducer 434 with polarity such that the concentrically mounted transducer 434 expands. The rate of expansion is controlled by the rise time of the high voltage pulse which is preset to generate a rapid expansion. The expansion of the transducer 434 causes the jetting tube 432, which is epoxied to the transducer 434, to also expand. The expansion of the tube 432 generates an acoustic expansion wave interior to the tube 432 which travels axially towards the orifice 433 and towards the fluid receiving aperture 431. When the expansion wave reaches the orifice 433, the reagent fluid is partially drawn inwardly. However, the surface tension of the fluid acts to inhibit substantial inward fluid movement.

When the expansion wave reaches the end 431 of the tube 432, the expansion wave is reflected and becomes a compression wave which travels towards the center of the piezo-electric tube 434. The high voltage pulse width is adapted such that when the reflected compression wave is beneath the piezo-electric tube 434, the high voltage pulse falls, resulting in a de-expansion of the transducer 434 and the jetting tube 432. This action adds to the existing acoustic compression wave in the interior of the jetting tube 432. The enhanced compression wave travels toward the orifice causing reagent fluid to be dispensed from the tube 432. The fluid is propelled from the orifice 433 as a small droplet 2 and deposited in the selected mixing cell 904 positioned by the transportation unit 902. One droplet 2 is dispensed for each transducer activation pulse. This mode of dispensing is referred to as the drop on demand mode.

In some instances, the droplet 2 may be accompanied by at least one smaller satellite droplet. However, even if satellite droplets are present, the volume and velocity of the reagent droplets 2 are highly reproducible. This reproducibility allows for precise dispensing of uniform, controllably sized droplets 2 of reagent fluid into the mixing cell 904.

The droplets 2 of reagents impact the mixing cell 904 with sufficient force and volume to cause fluidic mixing of the reagents. Once the desired amounts of the selected reagents are deposited in the selected mixing cell 904, mixing cell 904 is transported to the detection station 906 where the mixed reagents may be extracted for use or analyzed for assay results.

The dispensing system 30 provides numerous advantages based upon the ability of the reagent jetting head 400 to rapidly and reproducibly eject uniform quantities of a wide range of reagents. The reaction times of some chemical processes are dependent upon the volume of the reagents used. The ability of the dispensing system 30 to dispense such minute amounts of reagents thereby reduces the processing time

of certain chemical assays. Furthermore, some chemical assays require a wide range of dilution ratios. Many conventional dispensing systems are unable to dispense the reagents in volume small enough to make the desired assay practical. The dispensing system of the present invention overcomes this disadvantage.

5 In addition to dispensing reagent fluids, certain embodiments may be used for precision printing of reagents onto a printing medium such as filter paper to produce an assay test strip. A printing system 10 using the present invention is represented in Fig. 3. Structure similar in form and function to structure described above will be designated by like reference numerals. The printing system 10 comprises a reagent fluid reservoir 200, a filter 300, a reagent jetting head 400, a jetting head control unit 500, an
10 interface 600, a computer 700, and an x-y plotter 800.

The x-y plotter 800 is a commercially available pen plotter, mechanically modified in a conventional manner such that the pen is replaced with the jetting head 400. The general operation and structure of the plotter 800 will not be described in detail. The plotter 800 accepts commands from the computer 700 thru a standard RS-232 serial interface contained within the interface unit 600. The plotter 800 processes the
15 commands and produces control signals to drive an x-axis motor (not shown) and a y-axis motor (not shown). The x-axis motor is used to position the jetting head 400 and the y-axis motor is used to position a drum (not shown) to which the printing target 1 is attached.

The plotter 800 produces a pen down signal PENDN. This signal is applied to the control unit 500 and indicates that the plotter 800 is ready to begin a printing operation.

20 The control unit 500 also receives control signals from the interface unit 600. These signals include signals HIGHER*, LOWER* to control the magnitude of the pulse applied to the transducer 434; a reset signal RST to reset the control unit 500; and a series of print signals PRT*. The generation of these signals will not be described in detail since their production is performed by the conventional interface unit 600.

The jetting head 400 and fluid supply system 200, 300 are initialized and operate substantially as described above. The jetting head control unit 500, shown in Figs. 5a - 5e comprises a print control circuit 510, a pulse generator 530, a high voltage supply 540, and a strobe pulse generator 560. The control unit 500 also comprises a power supply. However, since the power supply is of conventional design it will not be shown or described in detail.

The print control circuit 510 receives the pen down signal PENDN from the plotter 800 and comprises a
30 transistor Q100, a one-shot circuit U100, two NAND-gates U101, U102, a line decoder multiplexer U107 and four inverters U103-U106. The pen down signal PENDN is applied to the base of the transistor Q100 by resistors R100, R101 and diode D100. The emitter of transistor Q100 is tied to ground and the collector is connected to the +5 volt supply by resistor R102.

The one-shot U100 comprises inputs A, B and an output Q. The B input of the one-shot U100 is
35 connected to the collector of the transistor Q100 and the A input is tied to ground. The time period of the pulse produced by the one-shot U100 is determined by a resistor R104, a variable resistor R105 and a capacitor C100. The output Q of the one-shot U100 is combined with the collector output of the transistor Q100 by the NAND-gate U101 and then inverted by the NAND-gate U102. The circuit is operative to produce an adjustable delay in the application of the pen down signal PENDN to the control unit 500.

40 The line decoder U107 is circuited to function as a 3 input AND-gate. The output of the NAND-gate U102 is applied to the first input of the decoder U107; the print signal line PRT* comprising a series of pulses from the interface unit 600 is applied to the second input; and a jetting head ON/OFF signal from switch S1 is applied to the third input. The inverter U106 inverts the output of the line decoder U107 to generate the print control signal PRT* and the inverters U103-U105 invert the control signals LOWER*,
45 HIGHER*, and RST signals, respectively.

The high voltage supply 540, shown in Fig. 5b, provides +175 volts DC to produce a maximum pulse of +150 volts peak to peak at the reagent jetting head 400. The high voltage supply 540 comprises differential amplifier U12 and transistors Q1, Q2, Q13, Q14. A stable reference voltage of -2.5 volts DC is produced at the junction of a reservoir R13, connected to the -15 volt supply, and a diode CR6, connected
50 to ground. The reference voltage is combined with a resistor R14 to produce an adjustable, stable voltage reference for the amplifier U12. The reference voltage is applied to the inverting input of the amplifier U12 through a resistor R11. The noninverting input of the amplifier U12 is connected to ground by a resistor R12. The amplifier U12, in combination with a feedback resistor R10, produces an output signal proportional to the difference of the voltage reference signal and the ground potential.

55 The output of the amplifier U12 is applied to the base of the transistor Q2 whose collector is connected to the +15 volt supply. The signal produced at the emitter of the transistor Q2 is applied to the base of the transistor Q1 through resistors R8, R6, R5, a transformer L1 and diodes CR4, CR2, CR1. The emitter of the transistor Q1 is connected to ground and the collector is connected to the +15 voltage supply through the

transformer L1. A diode CR3 connects the collector of the transistor Q1 to the junction of the resistor R5 and the diode CR4. The transistor Q1 is biased for proper operation by resistors R7, R8, R5. The resistor R7 and a capacitor C22 connect the junction of the resistor R8, R5 to the +15 voltage supply.

The transistor Q1 and the transformer L1 form a "flyback" blocking oscillator. Any increase in current supplied by the transistor Q1 produces an increase in energy transferred through the secondary winding of the transformer L1 and diode CR5. Therefore, an increase in current supplied by the transistor Q1 results in an increase in power available to the high voltage output. The diodes CR1-CR4 form a "Baker clamp" which prevents transistor Q1 from saturating. The clamp thereby avoids transistor storage time.

The diode CR5 is connected to a multiple pi filter formed by the inductors L3, L2, capacitors C24, C21, C41 and resistors R29. The multiple pi filter attenuates ripple and switching spikes in the signal supplied to the transistor Q13 which produces the high voltage output V^{++} . A resistor R64 connects the base of the transistor Q13 to the emitter and to the resistor U29. The base is also connected to the collector of the transistor Q14 by a resistor R65. The base of the transistor Q14 is connected to the +15 volt supply by a resistor R67 and to ground by a resistor R66. The emitter of the transistor Q13 provides a signal HV SENSE which is fed back to the inverting input of the amplifier U12 through a resistor R9. The high voltage output V^{++} is produced at the collector of the transistor Q13. The proper biasing of the transistor Q13 is provided by resistor R64 and the biasing circuit comprising the transistor Q14, resistors R67, R66, R65.

The pulse generator 530, shown in Figs. 5d, 5e, comprises an opto-isolator U18, a one-shot U23, a digital to analog (D/A) converter U30 and two binary counters U24, U25. The pulse generator 530 accepts control signals PRT⁺, LOWER⁺, HIGHER⁺, RST and produces the activation pulse which is applied to the transducer 434. In normal operation, the PRT⁺ control signal is supplied to the opto-isolator U18 by a jumper JMP between contact points E5, E6. The opto-isolator U18 is of conventional design and comprises a light emitting diode (LED) circuit and a photo-element circuit. A resistor R15 operates as the load resistor for the LED circuit of the isolator and a capacitor C25 suppresses transient noise on the voltage supply to the isolator U18. The output of the isolator U18 is applied to one input of the one-shot U23 whose time constant is adjustably determined by resistors R38, R25 and a capacitor C30. The pulse from the non-inverting output of the one-shot U23 is fed to the base of a transistor Q9. A resistor R39 sets the approximate base current of the transistor Q9 which is used as a level shifter for converting the CMOS signal level to the +15 volt DC signal level.

The control of the rise and fall rates of the pulse generator 530 is accomplished by directing a pair of current source transistors Q11, Q12 to charge and discharge a capacitor C57. The transistor Q11 is operative as a source of current and the transistor Q12 is operative as a sink for current. A transistor Q10 controls the level of the current by applying an appropriate bias current through a resistor R56 to the base of the transistor Q11. The biasing of the transistors Q11, Q12 is critical to the proper rise and fall rates. Therefore precision voltage references CR13, CR15 are used to provide respective bias reference voltages. A temperature compensation network is formed from zener diodes CR14, CR16 and resistors R55, R54 to maintain stable operation of the transistors Q11, Q12, respectively. The variable resistors R49, R52 may be used to adjust the fall time and rise time, respectively, of the output pulse applied to the reagent jetting head 400. A plurality of resistors R45, R46, R47, R48, R49, R51, R52, R53, R56, R57, R58 are used to properly bias the transistor Q10, Q11, Q12 and capacitors C55, C60 are circuited to maintain stability of the circuit.

The impedance of the output stage of the rise and fall circuitry Q10, Q11, Q12 is very high. With such a high impedance, circuit elements attached to the capacitor C57 could affect the linearity of the rise and fall time constants. Therefore, an FET input operational amplifier U32 is used as an impedance interface. The amplifier U32 is configured in the noninverting mode and circuited with capacitors C58, C59 for stability.

The output of the amplifier U32 is applied to an inverting amplifier U31 by means of a resistor R62. The amplifier U31 inverts and conditions the pulse control signal with the aid of resistors R59, R60. Resistors R61, R63, connected to the -15 voltage supply, provide a means for adjusting the DC level offset of the amplifier U31 output signal. Capacitors C51, C52 are connected to enhance the performance and stability of the circuit.

The output of the amplifier U31 is applied by means of a resistor R41 to the positive voltage reference signal input REF(+) of the D/A converter U30. The negative voltage reference signal input REF(-) is tied to ground by a resistor R40. The D/A converter U30 produces output signals IOUT⁺, IOUT⁻ which are proportional to the difference between the positive and negative voltage reference signal inputs REF(+), REF(-). Capacitors C48, C49, C50 are connected to the D/A converter U30 to enhance stability.

The D/A converter outputs IOUT⁺, IOUT⁻ are also proportional to an 8-bit binary value applied to inputs B1-B8. The binary value is supplied by the counters U24, U25 which are controlled by the function signals LOWER⁺, HIGHER⁺ and RST. The LOWER⁺ signal and the HIGHER⁺ signals are applied to the count up and

delay, the signal is ANDed with the closed enable switch S1 and the series of print pulses PRT. The result of the AND operation is the application of the PRT pulses to the pulse generator circuit 530.

The PRT signal is applied through the jumper JMP to the opto-isolator U18 and then to the one-shot U23. The one-shot U23 produces a pulse signal which is then converted from CMOS signal levels to the 15 volt DC signal level by the transistor Q9. The rise and fall circuitry comprising Q10, Q11, Q12 converts the square wave pulse into a pulse having the rise and fall characteristics preset by the resistors R49, R52. The conditioned pulse is then amplified by the amplifier U32 and applied to the amplifier U31.

The amplifier U31 converts the polarity of the conditioned pulse to that acceptable by the D/A converter U30 and supplies an adjustable DC offset. The DC offset is used to counteract possible distortion attributable to the amplifier U31. The distortion arises in that, for the amplifier U31 to be adequately responsive, a small degree of current must flow through the resistor R41. This current creates an offset condition at the output of the amplifier U29 which is then scaled by the D/A converter U30 in correspondence with the binary data. The resistor R63 allows a small amount of current to be applied to the amplifier U31 to control the offset voltage attributable to the current flowing through the resistor R41.

The D/A converter U30 scales the difference between the inputs REF(+), REF(-) using the binary data supplied to input lines 81-88 to produce a current output pulse IOUT and a current inverted output pulse IOUT. The two outputs IOUT, IOUT are fed to the amplifier U29 which convert the current outputs into a single voltage output. The scaled, conditioned pulse is then applied to the output circuit comprising the amplifier U28 and the transistors Q3, Q4, Q5, Q6, Q7. The circuit produces a high voltage pulse with the aforementioned rise and fall characteristics to drive the piezo-electric transducer 434.

The high voltage pulse is applied to the transducer 434 and causes a droplet 2 of fluid to be propelled onto the target 1. Since the pen down signal PENDN is still applied, additional droplets 2 are produced from the jetting head 400. The plotter 800 moves the jetting head 400 and target 1 along the desired path during the emission of the droplets 2 to produce the desired printed line. When the printing is complete, the plotter 800 removes the pen down signal PENDN and the droplet emission stops. Of course it should be understood that dots, circles and the like could be produced by appropriate positioning of the target 1 and jetting head 400.

The size and uniformity of the droplets 2, as well as the presence of any satellite droplets, may be observed with the aid of the scope 950 and the LED 900. The scope 950 and the LED 900 are positioned such that the droplets 2 pass between the scope 950 and the LED 900 and within the focal range of the scope 950. The strobe pulse when applied to the LED 900 causes the LED 900 to momentarily flash. The timing of the activation and the width of the pulse may be adjusted such that the flash occurs when the fluid, expelled in response to the high voltage pulse, is between the scope 950 and the LED 900. The dispensed quantity of fluid may then be observed in flight or at or near the moment of separation from the orifice 433. Corrections based on the observation may then be made to the system 10.

Since each droplet 2 is small in volume, the droplet 2 may be rapidly absorbed by the target 1, thereby allowing rapid and precise placement of a variety of reagents on the target 1 with reduced drying time and reduced potential of fluidity mixing. In addition, the ability to place small droplets 2 in a precise manner enables the target 1 to be printed in a high density matrix with a variety of reagents as isolated matrix elements.

In some printing applications, particularly when printing fluids of low viscosity and surface tension, it may be desirable to force the fluid through the jetting tube 432 under pressure and allow the vibrations produced by the transducer 434 to break the emitted fluid stream into precise droplets 2. Under this mode of printing, the emission of droplets 2 can not be stopped by cessation of the transducers activation pulse. It is therefore necessary to prevent fluid emission by other means. One preferred means of momentarily stopping emission of the droplets is shown schematically in Fig. 4. In this arrangement, structure similar to structure represented in Fig. 3 in form and function, is represented by like reference numerals.

The arrangement, generally represented by the numeral 20, includes a closed reagent recirculation system comprising a normally close three way valve 970, a sump 960 and a recirculation pump 980. In the continuous mode, the reagent fluid is forced out the orifice 433 by hydraulic pressure and broken into a series of substantially uniform droplets 2 by movement of the transducer 434. A regulated, filtered air supply 100 is used to pressurize the reagent fluid reservoir 200. The reagent fluid within the reservoir 200 may optionally be agitated by a magnetic stirrer unit 990. This is especially useful for reagent fluids comprising suspended particles.

The three-way valve 970 comprises a common channel, a normally open channel and a normally closed channel. The fluid is forced through the filter 300 and applied to the normally closed channel of the valve 970. When the normally closed channel is closed, the normally open channel of the valve 970 functions as a vent for the reagent jetting head 400. The common channel is connected to the reagent supply tube 430

of the jetting head 400. The reagent supply tube 430 is also connected to the sump 960.

In operation, the normally closed channel is opened by an appropriate signal supplied by the computer 700 which also closes the normally open channel. When the normally closed channel is opened, fluid is permitted to pass to the sump 960 and to the jetting head 400. The sump 960 collects the reagent fluid not transferred to the jetting head 400. The sump 960 supplies the collected fluid to the inlet side of the recirculating pump 880 which returns the fluid to the reservoir 200. The returned fluid is then mixed with the contents of the reservoir 200 and is available for recirculation.

When operating in the continuous mode, rather than interrupt the continuous stream of print pulses to the jetting head 400, the printing may be momentarily stopped by closing the normally closed channel of the valve 970. The closing of the normally closed channel stops the flow of reagent fluid to the jetting head 400 and allows the jetting head 400 to vent to atmospheric pressure. With the fluid supply blocked, the transducer 434 is unable to expel further droplets 2. Thus, if positioning of the target 1 by the plotter 800 requires a longer time interval than the time between droplet 2 emission, the computer 700 may close the normally closed channel of the valve 970. The plotter 800 may then position the target 1 or position a new target 1 as desired.

When printing, the active ingredient of the reagent is tailored to achieve a desired concentration per unit area on the target 1. However, to a certain extent the final concentration per unit area can be adjusted by varying the density of the droplets 2 printed on the target 1. The preferred embodiment is particularly well suited to this application due to its ability to print precise, discrete pels of reagent.

A second preferred embodiment of the jetting head is illustrated in Figs. 6a-6b and is generally represented as 400'. The jetting head 400' comprises housing formed into three sections 401', 402', 403'. The housing section 403' comprises a recessed region which forms the reagent fluid reservoir 200' when the housing section 403' is positioned against housing section 402'.

The jetting head 400' further comprises a piezo-electric transducer 434' and a reagent jetting tube 432' similar to those of the first embodiment. The jetting head 400' and the transducer 434' are most clearly shown in Fig. 6b. The jetting tube 432' defines an orifice 433' at one end and a reagent fluid receiving aperture 431' at the other end. The transducer 434' is mounted to the jetting tube 432' concentrically about the mid-region of the tube 432' with epoxy.

The transducer 434' and the jetting tube 432' are positioned in channels 420', 418', 416' located in the housing sections 402', 401'. The channel 416' comprises a plurality of sealing teeth 412' operative to engage and seal against the fluid receiving end 431' of the jetting tube 432'. The channel 416' is connected to the reagent fluid supply channel 430'. The supply channel 430' is connected with the fluid reservoir 200' by means of an aperture 431' through the housing section 402', shown in Fig. 6b.

The reservoir 200' comprises a flexible reservoir lining 201' adapted to contain the reagent fluid. The lining 201' comprises one aperture which is connected to the housing 402' to allow the fluid to pass from the lining 201'. A vent (not shown), located in the housing 403', allows the space between the reservoir 200' and the lining 201' to be vented or pressurized. A filter 300' is positioned within the aperture 202' to trap unwanted particulate foreign matter.

Electrical pulses are supplied to the transducer 434' by means of two contact pins 422'. The pins 422' are inserted through respective apertures 419' of the housing section 402' and respective apertures 421' of the housing section 403'. Two thin electrically conductive strips 410', 411', shown in Fig. 6b, are used to connect the transducer 434' with the contact pins 422'. A protective shield 405' extends from the housing position 403' to partially isolate the protruding portions of the contact pins 422'.

The function and operation of the jetting head 400' is similar to that of the jetting head 400 and therefore will not be discussed in detail. The collapsible inner lining 201' of the reservoir 200' allows the jetting tube 432' to be primed by pressurizing the reservoir 200' through the vent 205'. Once primed, the jetting head 400' may be used as described above in reference to the jetting head 400.

The jetting head 400' provides an advantage in that the entire fluidic system is contained in one housing. Such containment allows for fast and efficient replacement of the jetting heads without fluid contamination problems.

A third preferred embodiment of the jetting head is shown in Fig. 7 and generally represented as 400". The jetting head 400" comprises a housing 403", a reagent fluid supply tube 406", a piezo-electric transducer 434" and an orifice plate 404". The housing 403" defines a conically shaped fluid chamber 432". An orifice plate 404", defining an orifice 433", is fastened to the housing 403" such that the orifice 433" is located at or near the apex of the conical fluid chamber 432".

The fluid feed tube 406" is attached to the housing 403" and defines a supply channel 430". The supply channel 430" is in fluid communication with the fluid chamber 432" by means of a connecting channel 431". The base of the fluid chamber 432" is formed by the disc-shaped transducer 434". The transducer 434" is

held in position by a hold down plate 402" attached to the housing 403". The electrical connections to the transducer 434" are of conventional design and are therefore not shown. The housing 403" further comprises a threaded aperture 406" for mounting the jetting head 400".

The jetting head 400" operates in a manner similar to the jetting heads described above. However, in this jetting head the transducer 434" is normally disk shaped. When the electrical pulse is applied, the transducer 434" bends slightly, thereby altering the volume of the conically shaped jetting chamber 432". The change in volume of the chamber 432" causes the expulsion of fluid through the orifice 433" and the intake of fluid through the supply channel 430" as described in reference to the jetting head 400.

A fourth preferred embodiment of the jetting head is shown in Fig. 8 and is generally represented as 400". The jetting head 400" is very similar in form and function to the jetting head 400 and will not be described in detail. The jetting head 400" comprises two symmetrical housing sections. The sections may be connected together by means of apertures 409" and screws, not shown. When assembled, the housing sections 404", 402" form a T-shaped supply channel 410".

In operation, the jetting head 400" functions in a manner similar to the jetting head 400. The jetting head 400" is especially suited for use in the continuous mode, but may also be used in the drop on demand mode. In the continuous mode, the fluid is circulated continuously through the supply channel 430" allowing the jetting tube 432" to withdraw as much fluid as required.

By way of illustrating and with no limitations intended the following information is given to further illustrate the above described embodiments. The computer 700 is an IBM Corporation Personal Computer with 640 kbytes of RAM memory. The interface unit 600 is a Burr Brown interface unit model number PC 20001. The plotter 800 is manufactured by Houston Instrument as model number DMP-40. Communication between the plotter 800 and the interface unit 600 is performed through a standard asynchronous serial communication port.

The electrical pulse applied to the jetting head 400 to activate the transducer 434 comprises a rise time of approximately 5 usecs, a fall time of approximately 5 usecs and a pulse width of approximately 35 usecs. When the transducer 434 is operated in the drop on demand mode, the voltage potential of the pulse is 60 volts plus or minus 10 volts and the pulse frequency can be up to 4 khz. When the transducer 434 is operated in the continuous mode, the voltage potential of the pulse is 30 volts plus or minus 10 volts and the pulse frequency can be up to 10 khz.

The jetting tube 432 is manufactured from a pyrex glass tube and measures .027 inches outside diameter and .020 inches inside diameter. The tube is drawn to a closed taper in an electric furnace. The tapered end is then cut and ground to a desired orifice opening of .002 to .004 inches in diameter. The tube is cut to a final length of .945 inches in the case of the dispenser embodiment and ultrasonically cleaned in acetone. After being cleaned and dried the large end of the tube is fire polished. If desired, the orifice end of the tube may receive a coating, such as a hydrophobic polymer, to enhance droplet separation from the tube.

The supply tube 430 is formed from .023 inch inside diameter and .38 inch outside diameter polyethylene tubing produced by Intramedic Corp. as model number #14 170 11B. During assembly, one end of the tubing is stretched over a warm tapered mandrel. The stretched end of the supply tube 430 is then inserted over the large fire polished end of the jetting tube 432. The assembly is then cleaned and baked in a circulating air oven at 50°C. for 10 minutes.

The transducer 434 was purchased from Vernitron of Cleveland, Ohio as model number P2T-5H. The electrodes 437, 438 are comprised of nickel and are separated from each other on the outer surface of the transducer by approximately .030 inches. The jetting tube 432 is inserted into the cylindrical piezo-electric tube 434 and secured with epoxy manufactured by Epoxy Technology of Billerica, Massachusetts as model number 301. The epoxy is applied at the junction of the tube 432 and transducer 434 with a syringe. The epoxy flows along the tube 432 inside the transducer 434 by capillary action. The assembly is then baked in a circulating air oven at 65°C. for one hour to cure the epoxy.

The contact pins 422 are secured to one of the housing sections 402, 404 with a drop of epoxy. The transducer jetting tube 434, 432 is placed in the housing such that the orifice end 433 of the tube 432 protrudes approximately .030 inches from the housing 403, 404. A drop of silver epoxy is placed between each contact pin 422 and the transducer 434 to ensure a secure electrical connection. Epoxy is also applied to the junction of the housing 402, 404 and supply tube 430. The other section of the housing 402, 404 is then screwed into place.

The periphery of the housing 402, 404 is sealed with a capillary sealer such as cyclohexanone. Epoxy is then added around each contact pin 422 and around the orifice end 433. The assembly is then baked in a circulating air oven at 65°C. for one hour.

The filter 300 is formed from a polyester mesh with 30 um pores and positioned in a polypropylene

housing. The air pressure supplied to the reservoir 20C during continuous printing operations is regulated at approximately 10 to 30 psi.

The reagents used have the following characteristics:

Printing (drop on demand mode):

- 5 Fluid viscosity range: 1 - 30 centipoises
- Fluid surface tension: 20 - 70 dyne/cm

Printing (continuous mode):

- Fluid viscosity range: up to 50 centipoises
- Fluid surface tension: not measured

- 10 Dispensing (drop on demand mode):

- Fluid viscosity range: 2 - 30 centipoises
- Fluid surface tension: 20 - 70 dyne/cm

- A measure of the performance and selected operating characteristics for a typical jetting head are presented in Figs. 8-11. Fig. 8 is a graph of the mass of a droplet as a function of droplet emission frequency for three fluids. The viscosity of the fluids were 1, 5 and 24 centipoise and the transducer excitation pulse width was 35 microseconds. As shown in Fig. 9, the higher fluid viscosity results in a more stable operating performance of the jetting head. Fig. 10 is a graph of droplet velocity as a function of droplet emission frequency for fluid viscosities of 1, 5 and 24 centipoise. The log of the total fluid weight as a function of the log of the number of droplets emitted is shown in Fig. 11. The fluid used has a viscosity of 2 centipoise, a surface tension of 20 dynes/cm, and a density of .8 grams/cc. The transducer excitation pulse was 80 volts and the excitation frequency was approximately 711 Hz.

Some blood typing reagents and some allergen reagents have very low viscosities and surface tensions. Although in some cases viscosity modifiers, such as glycerol, dextran, glucose, and the like, may be added to increase the viscosity, a few reagents are adversely affected by such modifiers.

- 25 Developing stable and reproducible demand mode jetting is difficult with very low viscosities. Although droplet emission can be established at some fundamental frequencies, the droplets dispensed may have small satellite droplets which reduce the accuracy for metering and dispensing applications. However, even with the satellite drops, sufficient reagent is adequately delivered for most print applications without a substantial decrease in print quality.

- 30 Glycerin may be used as a viscosity modifier to improve jetting reliability and to prevent obstruction of the orifice arising from evaporation of the reagent fluid components. Glycerin has been found especially beneficial for those reagents containing particulate material. The evaporation of the fluid component results in a concentration of glycerin located at the orifice. The plug of glycerin substantially prevents further evaporation of the reagent fluid. During the next activation cycle of the transducer, the plug of glycerin is expelled from the orifice.

When operating in the dispensing mode the volume of the droplets can be varied to substantially uniformly contain from 100 pico-liters to 1 micro-liter. The droplets can be produced at a rate of approximately 1 kHz to 8 kHz. When operating in the printing mode the size of the dot made by each droplet measures approximately .001-.012 inches in diameter.

- 40 A copy of the program used in the computer 700 for a printing operation is attached hereto as Appendix A. The values, manufacturer and manufacturing part number of the circuit components of the jetting control unit 500 are substantially as follows:

Ref. Numeral of Component	Description and Value	Manufacturer and Part No.
R39, 45-48, 57, 58	RES. 10KOHM, WATTS% C.F.	
R66	RES. 150OHM, WATTS% C.F.	
R3	RES. 15KOHM, WATTS% C.F.	
R34	RES. 16KOHM, WATTS% C.F.	
R50	RES. 2.4KOHM, WATT1% M.F.	DALE RL079242C
R13, 23, 36, 40, 41	RES. 2.4KOHM, WATTS% C.F.	
R56	RES. 20KOHM, WATTS% C.F.	
R8	RES. 220OHM, WATTS% C.F.	
R6	RES. 270HM, WATTS% C.C.	
R7, 12, 25	RES. 2KOHM, WATTS% C.F.	
R67	RES. 3.6KOHM, WATTS% C.F.	
R51, 53	RES. 3.9KOHM, WATTS% C.F.	
R29	RES. 300KOHM, WATTS% C.F.	
R61	RES. 30KOHM, WATT1% C.F.	DALE RL079303C
R15-18, 26-28, 54, 55, 64	RES. 4.7KOHM, WATTS% C.F.	
R62	RES. 45.3KOHM, WATT1% M.F.	DALE RM55D4532F
R30, 33	RES. 470HM, WATTS% C.F.	
R21	RES. 470OHM, WATTS% C.F.	
R19	RES. 47KOHM, WATTS% C.F.	
R35	RES. 510OHM, WATTS% C.F.	
R43	RES. 5.2KOHM, WATTS% C.F.	
R60	RES. 7.5KOHM, WATTS% C.F.	
R37	RES. 75KOHM, WATTS% C.F.	
R9	RES. 76KOHM, WATT1% M.F.	DALE RM60D7622F
R11	RES. 820OHM, WATT5% C.F.	
U2, 11, 14, 16, 22	RES. DIP NETWRK. 47KOHM	CT9 761-1R47K
C21, 41, 45	CAP. AXIAL 1MF@250VDC	MALLORY #TC56
C24	CAP. AXIAL 220MF@250VDC	MALLORY
C10	CAP. AXIAL ALUM ELEC.	LF2219250C7P3
	4700 0MF@25VDC	MALLORY
C1, 2, 3, 55, 60	CAP. RADIAL DIPPED TANT.	TCG472UC25M1C
	10MF@25VDC	KEMET
C53	CAP. RADIAL DIPPED TANT.	T350E106M025AS
	1MF@35VDC	KEMET
C36	CAP. RADIAL DIPPED TANT.	T350A105K035AS
	47MF@10VDC	KEMET
		T350E566MC10AS

Ref. Numeral of Component	Description and Value	Manufacturer and Part No.
C54	CAP. RADIAL SILV MICA 100PF300VDC	KAHGAN SD5101J301
C57	CAP. RADIAL SILV MICA 20PF300VDC	KAHGAN SP12200J301
C49	CAP. RADIAL SILV. MICA 39PF300VDC	KAHGAN SP12390J301
C39	CAP. RADIAL X7R MLC .015MF@50VDC	KEMET C315C102K1R5CA
C6	CAP. RADIAL X7R MLC .022MF@50VDC	KEMET C315C223K5R5CA
C30, 35, 37	CAP. RADIAL 25U MLC .015MF@50VDC	KEMET C315C153K5R5CA
C4, 7	CAP. RADIAL 25U MLC .01MF@50VDC	KEMET C315C103K5R5CA
C4, 5, 6, 9, 11-19, 22, 23, 25-28 C31-34, 37, 42, 43 47, 48, 50-52	CAP. RADIAL 25U MLC .22MF@50VDC	KEMET C322C224M5U5CA
C56, 58, 59		
C46	CAP. VARI. 2-12PF.	JOHANSEN #9626
CR7, 8, 9, 10, 11, 12, 17	DIODE SIL.	ITT. FAIRCHILD. 1N4148
CR1, 2, 3, 4	DIODE SIL. FAST	GENL. INST. EGP10D
CR5	DIODE SIL. FASTHIVOLT	GENL. INST. UF4007
CR6, 13, 15	DIODE SIL. REF. 2, 500VDC	NATL. SEMI-LM3852-2.5
CR14, 16	DIODE SIL. ZENER 3.3V. 25WATT	MOTOROLA 1N4622A
U6, 13, 15, 17	SWITCH 8 POSITION DIP	CTS 206-8
Q2, 9, 12	TRANSTOR. COMMON NPN	MOTOROLA 2N2222A
Q8, 10, 11	TRANSTOR. COMMON PNP	MOTOROLA 2N2907A
Q4	TRANSTOR. HIVOLTHIFREQ. NPN	MOTOROLA MPSU10
Q7	TRANSTOR. HIVOLTHIFREQ. PNP	MOTOROLA MPSU60
Q1	TRANSTOR. HIVOLTHIINPN	TI, MOTOROLA TIP48
Q3, 14	TRANSTOR. HIVOLTHIINPN2N3439	MOTOROLA 2N3439
Q13	TRANSTOR. HIVOLTHIPNP	MOTOROLA MJE5731
U5, 27	IC 1-SHOT 74HC221	NATL. SEMI MM74HC221IN
U23, 26	IC 1-SHOT 74LS221	NATL. SEMI DM741S221N
U7-10	IC COMPARATOR 74HC688	NATL. SEMI MM74HC688N
U30	IC CONVERTER DAC0800	NATL. SEMI DAC0800LCN
U24, 25	IC COUNTER 74HC193	NATL. SEMI MM74HC193N
U28	IC HI SLEW HI VOLT OP AMP	BURR-BROWN 3584JM
U1	IC HYBRID DC/DC CONVERTER	BURR-BROWN MODEL 724
U4	IC OC DRIVER SN7406	NATL. SEMI DM7406N
U3	IC OCTAL LATCH 74HC374	NATL. MM74HC374N
U12, 29, 31, 32	IC OP AMP LF256	NATL. SEMI LF256H
U18, 19, 20, 21	IC OPTO ISOLATOR	HEWLETT-PACKARD HCPL2300
R24, 42, 63	POT100KOHM, WATT10%	BOURNS 3622-1-104
R38, 49, 52	POT10KOHM, WATT10%	BOURNS 3622W-1-103
R20	POT25KOHM, WATT10%	BOURNS 3622W-1-253
R14, 31	POT2KOHM, WATT10%	BOURNS 3622W-1-202

<u>Ref. Numeral of Component</u>	<u>Description and Value</u>	<u>Manufacturer and Part No.</u>
6 VRI	REGULATOR 5VDC	
R10	RES. 1MEG OHM 1/2 WATT 5% C.F.	NATL. LM340T-5.0
R2, 4	RES. 1.2K OHM 1/2 WATT 5% C.F.	
R32	RES. 1.6K OHM 1/2 WATT 5% C.F.	
R44	RES. 1.8K OHM 1/2 WATT 5% C.F.	
R1	RES. 10MEG OHM 1/2 WATT 5% C.F.	
10 R5, R22	RES. 100 OHM 1/2 WATT 5% C.F.	
R65	RES. 100K OHM 1/2 WATT 5% C.F.	
R59	RES. 10K OHM 1/2 WATT 1% C.F.	DALE RN55D1002F
R100	RES. 270 OHM	
R101, 108	RES. 470 OHM	
15 R102, 103	RES. 1K OHM	
106, 109, 110		
R104	RES. 470 OHM	
R105	PCT. 100K OHM	
R107	POT. 10K OHM	
20 R111, 113	RES. 220 OHM	
R112	RES. 22 OHM	
R114, 115	RES. 47 OHM	
C100	CAP. 10MEG OHM 35 VFC	
C108	CAP. 10000 PF	
25 D100	DIODE	1N4148
Q100, 105	TRANSTOR	2N2222
Q101, 102	TRANSTOR	2N3906
Q103, 104	TRANSTOR	2N3904
U100, U108	IC 1-SHOT	74LS123
30 U103, 104	IC INVERTOR	74LS04
105, 106		
U108	IC LINE DECODER	74LS138

Of course, it should be understood that a wide range of changes and modifications can be made to the preferred embodiments described above. For example, the transducer could be of a type other than piezo-electric such as magneto-strictive, electro-strictive, and electro-mechanical. It is therefore intended that the foregoing detailed description be regarded as illustrative rather than limiting, and that it be understood that it is the following claims, including all equivalents, which are intended to define the scope of this invention.

APPENDIX

8 Request Jet Printer
Request Calibration

PAGE 1
87-10-06
12:26:57
IBM Personal Computer BASIC Compiler V2.00

```

Offset  Data  Source Line
10 0030 0004  REM TITLE:"Request Jet Printer" :$SUBTITLE:"Request Calibration" :$LINESIZE:132
    0030 0004  "MODEL" - "REACH"
    0030 0004
    0030 0004  "AUTHOR" - R. A. Everett
    0030 0004
    0030 0004  "COPYRIGHT" (C) 1985 ABBOTT LABORATORIES
15 0030 0004  "REVISION" - 2.0 07-01-84 RAE MicroFab modifications
    0030 0004  - 1.0 02-11-84 RAE Creation of initial code
    0030 0004
    0030 0004  "NOTES" - This code can only be compiled by the BASCOM
    0030 0004  COMPILER, it will not run under the INTERPRETER!!
    0030 0004
20 0030 0004  "DESCRIPTION:"
    0030 0004  The request calibrate module presents a menu with 12 items arranged
    0030 0004  in 3 columns of 4 rows. The arrow keys allow movement around the
    0030 0004  table, the + and - keys increment or decrement values in the first
    0030 0004  column, and the enter key executes commands in the third column.
    0030 0004  The second column is an array of ASCII strings representing request name,
25 0030 0004  concentration, density, and viscosity. The values entered in column one
    0030 0004  are drop frequency, pulse width, stroke delay, and nozzle number.
    0030 0004  The commands in the third column are start/stop, load, save, and exit.
    0030 0004
    0030 0004  "DATA DICTIONARY"
    0030 0004  *
    0030 0004  * NAME: Pointer to which menu item is active (0-11)
30 0030 0004  * MENU(17,1) Array for strings used to display the menu
    0030 0004  * MENU(17,4) Array for numbers in the menu display
    0030 0004  * DIFF: Differential to move MENU at arrow key input
    0030 0004  * TYPE: Pointer set during menu scan to direct action
    0030 0004  * KEYPTR: Storage for string input from menu display
    0030 0004  * AS: Destination for single keystroke inputs
35 0030 0004  * FILE: String where filename is built for request data file
    0030 0004  * REMARKS: String where request name is stored
    0030 0004  * G1: Row to display special graphics character in menu
    0030 0004  * G2: Column to display special graphics character in menu
    0030 0004  * G3: Special graphics character is read into here
    0030 0004  * PLS.AMP.VALUE: Integer value for setting pulse amplitude
40 0030 0004  * STR.VALUE: Value set to digital port 0 to fac/sec amplitude
    0030 0004
    0030 0004  END REMARKS.CALIBRATE STATIC
    0047 0004
    0047 0004  DIM MENU(17,1),MENU(17,4)
    0048 01FE
45 0048 01FE  REMARKS INITIALIZE: "read init. values and set screen"
    0048 01FE
    0048 01FE  WHILE TYPE < 1
    0051 0200
    0051 0200  TYPE = 0
    0048 0200  AS = ""
50 0048 0204
    0048 0204  WHILE AS = ""
    0079 0204  AS = INKEY$
    0083 0204  IF ACTIVE = 1 AND DOWNTIME < TIMER THEN GOSUB PCL.DONE
    0088 0204  REM
55 0088 0204

```

6

10

15

20

Resquest Jet Printer
Resquest Calibration

PAGE 2
07-14-86
12:24:37

Offset Data Source Line

IHA Personal Computer BASIC Compiler V2.00

```

25 0080 020A      IF AS = CHR$(13) THEN TYPE$ = 1:      'execute (cr)
    00CA 020A      IF AS = "+" THEN TYPE$ = 2:          'increment variable
    00E0 020A      IF AS = "-" THEN TYPE$ = 3:          'decrement variable
    00F6 020A      IF AS = CHR$(8) + CHR$(72) THEN TYPE$ = 4: 'up arrow key
    0112 020A      IF AS = CHR$(8) + CHR$(80) THEN TYPE$ = 5: 'down arrow key
    0140 020A      IF AS = CHR$(8) + CHR$(73) THEN TYPE$ = 6: 'left arrow key
    0163 020A      IF AS = CHR$(8) + CHR$(77) THEN TYPE$ = 7: 'right arrow key
30 018A 020A      IF AS > CHR$(47) AND AS < CHR$(123) THEN TYPE$ = 8: 'ascii 0 - z
    01C2 020A
    01C2 020A      ON TYPE$ GOSUB T1, T2, T3, T4, T5, T6, T7, T8
    01D8 020A
    01D8 020A      YES
    01DF 020A      TYPE$ = 0
    01EA 020A
    01EA 020A      EXIT SUB
    01EA 020A      KEY SPACE

```

40

45

50

55

8 Reagent Jet Printer
Reagent Calibration

PAGE 3
07-14-86

12:28:37

IBM Personal Computer BASIC Compiler V2.00

```

Offset  Data  Source Line
-----
10 01EA 0204 ***** SUBROUTINES FOR THIS MODULE *****
01EA 0204
01EA 0204 T11:          'set command
01EF 0204 IF PERJL < 12 THEN TYPEL = 0:RETURN: 'exit to print menu, no action
0205 020C OR REJUL = 11 GOSUB T1A, T1B, T1C, T1D
021A 020C IF REJUL < 13 THEN TYPEL = 0
022C 020C RETURN
15 023A 020C
023A 020C T1A:          'start/stop drop flow
023B 020C IF REJUL(12,0) = "START" THEN GOSUB START.INK
023C 020C IF REJUL(12,0) = "STOP" THEN GOSUB STOP.INK
023D 020C REJUL(12,0) = TEMP9
023E 020C COLOR 0,7:GOSUB DISPHEND
023F 020C RETURN
20 024C 0210
024C 0210 START.INK:
0250 0210 TEMP9 = "STOP"
0255 0210 CALL OUT.CH: 'to mode PC1
025F 0210 LOCATE 17,71:COLOR 27,3:PRINT "PRINTING"
25 0263 0210 ACTIVE9 = 1
02F1 0210 RETURN
02FC 0210
02FC 0210 STOP.INK:
0301 0210 TEMP9 = "START"
030B 0210 CALL OUT.CH: 'to mode PC1
0317 0210 LOCATE 17,71:COLOR 15,0:PRINT " ";
0339 0210 ACTIVE9 = 0
0344 0210 RETURN
0348 0210
0348 0210 T1B:          'load reagent profile
35 0349 0210 IF REJUL(16,1) = "" THEN LOCATE 22,1:PRINT "Reagent Name is not specified";GOSUB ANYKEY:RETURN
0391 0210
0391 0210 GOSUB SEARCH
0397 0210
0397 0210 IF I2 < (REJUL(16) + 1) THEN GOTO FOUND
03A8 0214 LOCATE 22,10-LEN(REJUL(16,1))/2:PRINT REJUL(16,1); " not found"
40 0404 0214 GOSUB ANYKEY: 'wait for a keyhit
0408 0214 RETURN
040E 0214
040E 0214 FOUND:
0412 0214 FILES = RIGHT$(STR$(I2),LEN$(STR$(I2))-1) + ".REA.B77"
0437 0218 OPEN FILES FOR INPUT AS #1: 'set pattern data file for read
45 0448 0218 INPUT #1,REJUL(0,0): 'read frequency
0448 0218 INPUT #1,REJUL(1,0): 'read amplitude
0489 0218 INPUT #1,REJUL(2,0): 'read stroke delay
04A8 0218 INPUT #1,REJUL(3,0): 'read pulse width
04B1 0218 INPUT #1,REJUL(4,0): 'read rise time
04F4 0218 INPUT #1,REJUL(5,0): 'read fall time
50 0519 0218
0519 0218 INPUT #1,REJUL(7,1): 'read concentration
0539 0218 INPUT #1,REJUL(8,1): 'read density
05A1 0218 INPUT #1,REJUL(9,1): 'read viscosity
05B3 0218 INPUT #1,REJUL(10,1): 'read surface tension
55 05A9 0218

```

5 Request Jet Printer
Request Calibration

PAGE 4
07-16-86
12h26m37

IBM Personal Computer BASIC Compiler V2.00

```

Offset  Data  Source Line
-----
0549 0218      CLOSE #1:      'done with data file
10 0550 0218      OPEN "HEADIR.RJP" FOR OUTPUT AS #1
0552 0218      PRINT #1,FILES:      'save filenames in default file
0553 0218      PRINT #1,REMU(1,1):  'save the directory name as well
0554 0218      CLOSE #1
0555 0218      GOSUB 9157.PARMS:      'show all parameters
15 0556 0218      RETURN
0603 0218      T1:      'save request profile
0605 0218      IF REMU(1,1) = "" THEN LOCATE 25,1:PRINT "Request Name is not specified";GOSUB ANTEY:RETURN
0606 0218      OPEN "HEADIR.RJP" FOR INPUT AS #1
0607 0218      INPUT #1,REARUNE
0608 0218      CLOSE #1
20 0609 0218      IF REARUNE < 80 THEN GOTO SAVE.REA
0610 0218      LOCATE 25,1:PRINT "Directory is full (80 requests max.)"
0611 0218      GOSUB ANTEY:RETURN
0612 0218      SAVE.REA:
0613 0218      GOTO SEARCH
25 0614 0218      IF I2 > REARUNE THEN GOTO SAVEREAL
0615 0218      REARUNE = I2
0616 0218      COLOR 15,0
0617 0218      LOCATE 25,1:PRINT REMU(1,1);' already exists. Replace it with new values? ";
0618 0218      AS = ""
0619 0218      WHILE AS = ""
30 0620 0218          AS = INKEY$
0621 0218      WEND
0622 0218      LOCATE 25,1:PRINT SPACES(77);
0623 0218      IF AS = "Y" OR AS = "y" THEN GOTO REPLACE
0624 0218      RETURN
35 0625 0218      SAVEREAL:
0626 0218      R1:      'delete old backup directory
0627 0218      MAKE "HEADIR.OLD" AS "HEADIR.OLD":      'save old directory
0628 0218      OPEN "HEADIR.OLD" FOR INPUT AS #1
0629 0218      OPEN "HEADIR.RJP" FOR OUTPUT AS #2:      'set up new dir
40 0630 0218      INPUT #1,REARUNE:      'read number of dir entries
0631 0218      REARUNE = REARUNE + 1:      'increase by 1
0632 0218      WRITE #2,REARUNE:      'save to new directory
0633 0218      FOR I=1 TO REARUNE - 1
45 0634 0218          LINE INPUT #1,AS:      'read entry from old dir
0635 0218          PRINT #2,AS:      'write entry to new directory
0636 0218      NEXT I
0637 0218      CLOSE #1
0638 0218      PRINT #2,REMU(1,1):      'write new entry to new directory
50 0639 0218      CLOSE #2:      'done with directory
0640 0218      REPLACE:
0641 0218      FILES = RIGHT$(STR$(REARUNE),LEN$(STR$(REARUNE))-1) + ".RJP"
0642 0218
65 0643 0218

```

Request Jet Printer
Request Calibration

PAGE 3

07-14-86

12:51:37

IBM Personal Computer BASIC Compiler V2.00

Offset	Data	Source Line
10	0000	0020 OPEN FILES FOR OUTPUT AS #1: 'create new pattern data file
	0010	0020 WRITE #1,REQM(0,0): 'store frequency
	0020	0020 WRITE #1,REQM(1,0): 'store amplitude
	0030	0020 WRITE #1,REQM(2,0): 'store strobe delay
	0040	0020 WRITE #1,REQM(3,0): 'store pulse width
	0050	0020 WRITE #1,REQM(4,0): 'store rise time
	0060	0020 WRITE #1,REQM(5,0): 'store fall time
15	0070	0020
	0080	0020
	0090	0020
	00A0	0020
	00B0	0020
	00C0	0020
	00D0	0020
	00E0	0020
20	00F0	0020
	0100	0020
	0110	0020
	0120	0020
	0130	0020
	0140	0020
	0150	0020
	0160	0020
	0170	0020
	0180	0020
	0190	0020
	01A0	0020
	01B0	0020
	01C0	0020
	01D0	0020
	01E0	0020
	01F0	0020
	0200	0020
	0210	0020
	0220	0020
	0230	0020
	0240	0020
	0250	0020
	0260	0020
	0270	0020
	0280	0020
	0290	0020
	02A0	0020
	02B0	0020
	02C0	0020
	02D0	0020
	02E0	0020
	02F0	0020
	0300	0020
	0310	0020
	0320	0020
	0330	0020
	0340	0020
	0350	0020
	0360	0020
	0370	0020
	0380	0020
	0390	0020
	03A0	0020
	03B0	0020
	03C0	0020
	03D0	0020
	03E0	0020
	03F0	0020
	0400	0020
	0410	0020
	0420	0020
	0430	0020
	0440	0020
	0450	0020
	0460	0020
	0470	0020
	0480	0020
	0490	0020
	04A0	0020
	04B0	0020
	04C0	0020
	04D0	0020
	04E0	0020
	04F0	0020
	0500	0020
	0510	0020
	0520	0020
	0530	0020
	0540	0020
	0550	0020
	0560	0020
	0570	0020
	0580	0020
	0590	0020
	05A0	0020
	05B0	0020
	05C0	0020
	05D0	0020
	05E0	0020
	05F0	0020
	0600	0020
	0610	0020
	0620	0020
	0630	0020
	0640	0020
	0650	0020
	0660	0020
	0670	0020
	0680	0020
	0690	0020
	06A0	0020
	06B0	0020
	06C0	0020
	06D0	0020
	06E0	0020
	06F0	0020
	0700	0020
	0710	0020
	0720	0020
	0730	0020
	0740	0020
	0750	0020
	0760	0020
	0770	0020
	0780	0020
	0790	0020
	07A0	0020
	07B0	0020
	07C0	0020
	07D0	0020
	07E0	0020
	07F0	0020
	0800	0020
	0810	0020
	0820	0020
	0830	0020
	0840	0020
	0850	0020
	0860	0020
	0870	0020
	0880	0020
	0890	0020
	08A0	0020
	08B0	0020
	08C0	0020
	08D0	0020
	08E0	0020
	08F0	0020
	0900	0020
	0910	0020
	0920	0020
	0930	0020
	0940	0020
	0950	0020
	0960	0020
	0970	0020
	0980	0020
	0990	0020
	09A0	0020
	09B0	0020
	09C0	0020
	09D0	0020
	09E0	0020
	09F0	0020
	0A00	0020
	0A10	0020
	0A20	0020
	0A30	0020
	0A40	0020
	0A50	0020
	0A60	0020
	0A70	0020
	0A80	0020
	0A90	0020
	0AA0	0020
	0AB0	0020
	0AC0	0020
	0AD0	0020
	0AE0	0020
	0AF0	0020
	0B00	0020
	0B10	0020
	0B20	0020
	0B30	0020
	0B40	0020
	0B50	0020
	0B60	0020
	0B70	0020
	0B80	0020
	0B90	0020
	0BA0	0020
	0BB0	0020
	0BC0	0020
	0BD0	0020
	0BE0	0020
	0BF0	0020
	0C00	0020
	0C10	0020
	0C20	0020
	0C30	0020
	0C40	0020
	0C50	0020
	0C60	0020
	0C70	0020
	0C80	0020
	0C90	0020
	0CA0	0020
	0CB0	0020
	0CC0	0020
	0CD0	0020
	0CE0	0020
	0CF0	0020
	0D00	0020
	0D10	0020
	0D20	0020
	0D30	0020
	0D40	0020
	0D50	0020
	0D60	0020
	0D70	0020
	0D80	0020
	0D90	0020
	0DA0	0020
	0DB0	0020
	0DC0	0020
	0DD0	0020
	0DE0	0020
	0DF0	0020
	0E00	0020
	0E10	0020
	0E20	0020
	0E30	0020
	0E40	0020
	0E50	0020
	0E60	0020
	0E70	0020
	0E80	0020
	0E90	0020
	0EA0	0020
	0EB0	0020
	0EC0	0020
	0ED0	0020
	0EE0	0020
	0EF0	0020
	0F00	0020
	0F10	0020
	0F20	0020
	0F30	0020
	0F40	0020
	0F50	0020
	0F60	0020
	0F70	0020
	0F80	0020
	0F90	0020
	0FA0	0020
	0FB0	0020
	0FC0	0020
	0FD0	0020
	0FE0	0020
	0FF0	0020
	1000	0020
	1010	0020
	1020	0020
	1030	0020
	1040	0020
	1050	0020
	1060	0020
	1070	0020
	1080	0020
	1090	0020
	10A0	0020
	10B0	0020
	10C0	0020
	10D0	0020
	10E0	0020
	10F0	0020
	1100	0020
	1110	0020
	1120	0020
	1130	0020
	1140	0020
	1150	0020
	1160	0020
	1170	0020
	1180	0020
	1190	0020
	11A0	0020
	11B0	0020
	11C0	0020
	11D0	0020
	11E0	0020
	11F0	0020
	1200	0020
	1210	0020
	1220	0020
	1230	0020
	1240	0020
	1250	0020
	1260	0020
	1270	0020
	1280	0020
	1290	0020
	12A0	0020
	12B0	0020
	12C0	0020
	12D0	0020
	12E0	0020
	12F0	0020
	1300	0020
	1310	0020
	1320	0020
	1330	0020
	1340	0020
	1350	0020
	1360	0020
	1370	0020
	1380	0020
	1390	0020
	13A0	0020
	13B0	0020
	13C0	0020
	13D0	0020
	13E0	0020
	13F0	0020
	1400	0020
	1410	0020
	1420	0020
	1430	0020
	1440	0020
	1450	0020
	1460	0020
	1470	0020
	1480	0020
	1490	0020
	14A0	0020
	14B0	0020
	14C0	0020
	14D0	0020
	14E0	0020
	14F0	0020
	1500	0020
	1510	0020
	1520	0020
	1530	0020
	1540	0020
	1550	0020

8
 Request Jet Printer
 Request Calibration

PAGE 6
 07-14-86
 12:24:57

IBM Personal Computer BASIC Compiler V2.00

Offset	Data	Source Line
10 0C30	022E	DELTA TIME = NEW TIME - OLD TIME
0C40	022E	OLD TIME = NEW TIME
0C50	022E	IF DELTA TIME > 0.15 THEN MULT = 1 ELSE MULT = MULT * 1
0C77	022E	IF MULT > 100 THEN MULT = 100
0C89	022E	NEW(NEWOUT,0) = NEW(NEWOUT,0) + NEW(NEWOUT,3) * MULT: 'sub increment
0C93	022E	IF NEW(NEWOUT,0) < NEW(NEWOUT,2) THEN NEW(NEWOUT,0) = NEW(NEWOUT,2): 'check min value
18 0B32	022E	COLOR IS,1:GOSUB DISPMENU:RETURN: 'show new value
0B49	022E	
0B49	022E	T4: 'process up arrow key
0B4E	022E	IF NEW(ROW) = 0 THEN RETURN: 'in top row already
0B63	022E	DIFF = -1:GOSUB KEYMENU:RETURN: 'move pointer up one
0B76	0230	
20 0B7A	0230	T5: 'process down arrow key
0B79	0230	IF NEW(ROW) = 5 THEN RETURN: 'in bottom row already
0B8F	0230	DIFF = 1:GOSUB KEYMENU:RETURN: 'move pointer down one
0B40	0230	
0B40	0230	T6: 'process left arrow key
0B45	0230	IF INT(NEW(C) / 4) = 0 THEN RETURN: 'in left column already
25 0B55	0230	DIFF = -4:GOSUB KEYMENU:RETURN: 'move pointer one left
0B66	0230	
0B66	0230	T7: 'process right arrow key
0B6B	0230	IF INT(NEW(C) / 4) = 2 THEN RETURN: 'in right column already
0B7E	0230	DIFF = 4:GOSUB KEYMENU:RETURN: 'move pointer one right
0B8F	0230	
30 0B9F	0230	T8: 'input keys into KEYBUF until (cr) is entered
0B14	0230	IF NEW(C) = 10 THEN RETURN
0B23	0230	LOCATE 25,30:COLOR 31,0:PRINT "ENTER NEW VALUE";:COLOR 15,0
0B23	0230	KEYBUF = ""
0B2F	0234	WHILE AS <> CHR\$(13)
0B72	0234	LOCATE 25,47:PRINT SPACE\$(10);
35 0B8F	0234	LOCATE 25,47:PRINT KEYBUF;
0B4F	0234	AS = ""
0B53	0234	WHILE AS = ""
0B5C	0234	AS = INKEY
0B5C	0234	IF ACTIVE1 = 1 AND NEW TIME < TIME THEN GOSUB PER.SCHM
0B76	0234	END
40 0B79	0234	IF AS = CHR\$(8) AND LEN(KEYBUF) > 0 THEN KEYBUF = LEFT\$(KEYBUF,LEN(KEYBUF)-1)
0B79	0234	IF AS = CHR\$(13) AND LEN(KEYBUF) < 15 THEN KEYBUF = KEYBUF + AS
0B75	0234	END
0B79	0234	IF NEW(C) > 5 THEN GOTO STORESTR
0B79	0234	
45 0B8B	0234	TEMP = VAL(KEYBUF) 'temp has value of keys input
0B7B	0230	
0B7B	0230	'round off temp according to step size in menu array
0B7B	0230	TEMP = INT(TEMP / (NEW(NEWOUT,3) * .5)) * NEW(NEWOUT,3)
0B7B	0230	
50 0B7B	0230	'test TEMP for obvious and obvious values in menu array
0B7B	0230	IF TEMP > NEW(NEWOUT,1) THEN TEMP = NEW(NEWOUT,1)
1019	0230	IF TEMP < NEW(NEWOUT,2) THEN TEMP = NEW(NEWOUT,2)
104F	0230	
104F	0230	'insert new value into menu array and update screen
104F	0230	NEW(NEWOUT,0) = TEMP
55 104B	0230	LOCATE 25,30:PRINT SPACE\$(40);

8 Request Jet Printer
Request Calibration

PAGE 7

07-11-84

12:24:37

(BR Personal Computer BASIC Compiler V2.00)

Offset	Date	Source Line
10	1098 0728	COLOR 0,7:GOSUB DISPCOLOR
	1098 0728	RETURN
	1098 0728	
	1098 0728	SUBROUTINE:
	1098 0728	RETURN
	1098 0728	LOCATE 25,20:PRINT SPACE(40):
15	1098 0728	COLOR 0,7:GOSUB DISPCOLOR
	1098 0728	RETURN
	1098 0728	
	1098 0728	PEL:DOEN:
	1098 0728	DOEN:TIME = TIME + 1
	1098 0728	PRINT 0,0
20	1117 0728	RETURN
	1118 0728	
	1118 0728	ACTIVE:
	1118 0728	LOCATE 25,14:PRINT "Strike any key.."
	1118 0728	AS = ""
	1118 0728	WHILE AS = ""
25	1153 0728	AS = INKEY
	1153 0728	END
	1153 0728	LOCATE 25,1:COLOR 15,0:PRINT SPACE(79):COLOR 15,1
	1153 0728	RETURN
	1153 0728	
	1153 0728	REMARKS: "write old item in yellow, point to and highlight new item"
30	1198 0728	COLOR 14,0:GOSUB DISPCOLOR
	1198 0728	RETURN
	1198 0728	IF ACNT = 11 THEN ACNT = 10
	1198 0728	IF ACNT > 15 THEN ACNT = 15
	1198 0728	COLOR 0,7:GOSUB DISPCOLOR:RETURN
35	1198 0728	
	1198 0728	INITIALIZE:
	1198 0728	"change to second screen and display messages"
	1198 0728	SCREEN 0,0,1:COLOR 7,0:CLS:LOCATE 10,20:PRINT "Initializing Aneu Display"
	1198 0728	LOCATE 12,20:PRINT "Please Wait..."
40	1258 0728	"initialize variables"
	1258 0728	
	1258 0728	ACTIVE = 0: not printing
	1258 0728	
	1258 0728	"initialize plotter con channel"
	1258 0728	
45	1258 0728	OPEN "CON:2400,8,8,2" AS #5
	1258 0728	PRINT #5,"(LINE,EPV1,8)"
	1258 0728	
	1258 0728	"Initialize digital port"
	1258 0728	MODE = 4
	1258 0728	CALL DIGITAL.OUT(MODE)
50	1258 0728	MODE = 0
	1258 0728	CALL DIGITAL.OUT(MODE):
	1258 0728	MODE = 4
	1258 0728	CALL DIGITAL.OUT(MODE)
	1258 0728	
	1258 0728	"set hardware pulse width"
55	1258 0728	CALL SET.PUL.WIDTH(1) "in module PCI"

5

10

15

20

Request Jet Printer
Request Calibration

PAGE 9

07-14-86

13:24:57

IBM Personal Computer BASIC Compiler V2.00

Offset	Data	Source Line
25	1814 0244	DISP.PARMS:
	1819 0244	'display 18 menu choices in yellow
	1819 0244	
	1819 0244	COLOR 14,0
	1825 0244	FOR MENU = 0 TO 17
30	1828 0244	GOSUB DISPMENU
	1831 0244	NEXT MENU
	1841 0244	
	1841 0244	'set for request name and highlight it
	1841 0244	MENU = 4:COLOR 0,7
	1854 0244	GOSUB DISPMENU
35	185A 0244	
	185A 0244	SCREEN 0,0,0,0
	186F 0244	RETURN
	1873 0244	END PAGE

40

45

50

55

Request Jet Printer
Request Calibration

PAGE 10
07-14-84
12:24:57

IBM Personal Computer BASIC Compiler V2.00

```

10 Offset  Data  Source Line
1873 0214  DISPOSE:
1878 0214  LOCATE (XPOS+1) * 2+7, (INT (XPOS/31)+28+2) * 15+INT (XPOS/32)
1884 0214  PRINT XPOS+XPOS,0)
1887 0214  IF XPOS > 5 THEN GOTO SHOWSTRIDE: ' no value to display
1901 0214  LOCATE (XPOS+1) * 2+7, XPOS+XPOS,1)
1903 0214  PRINT USING XPOS (XPOS,1); XPOS+XPOS,0);
1906 0214  IF XPOS > 2 THEN RETURN
1975 0214  ON XPOS+1 GOSUB SET.FREQ, SET.AMP, SET.RELAY
1984 0214  RETURN
20 1984 0214  SHOWSTRIDE:
1987 0214  IF XPOS > 10 THEN RETURN
1996 0214  LOCATE (XPOS+1) * 2+7,0)
1998 0214  PRINT "
1997 0214  LOCATE (XPOS+1) * 2+7,0)
1998 0214  PRINT XPOS+XPOS,1)
2002 0214  RETURN
25 1A06 0214  SET.FREQ:
1A08 0214  TEMP = XPOS(0,0)
1A24 0214  CALL SET.DUT.RATE(TEMP): 'in module PCI
1A34 0214  LED% = 2-INT((TEMP+500)/1000)
1A57 0214  IF LED% < 0 THEN LED% = 0
30 1A59 0214  SCORE = 4 * (LED% + 32): 'set LED intensity
1A89 0214  CALL DIGITAL.OUT(SCORE): 'in module PCI
1A99 0214  RETURN
1A99 0214  SET.AMP:
35 1A82 0214  SCORE = CINT(XPOS+XPOS,0) * 25 / 100: 'convert volts to binary number
1A83 0214  IF SCORE = OLD.AMP.VALUE THEN RETURN
1A8C 0214  TEMP = SCORE - OLD.AMP.VALUE: 'calculate delta
1A8D 0214  OLD.AMP.VALUE = SCORE: 'update old value to current value
1A8F 0214  DIG.VALS = 0
1A91 0214  IF TEMP < 0 THEN DIG.VALS = 5
40 1A88 0214  TEMP = ABS(TEMP)
1B15 0214  FOR I = 1 TO TEMP
1B22 0214  SCORE = DIG.VALS * (32+LED%)
1B37 0214  CALL DIGITAL.OUT(SCORE): 'pulse higher or lower
1B4F 0214  SCORE = 4 * (32 + LED%)
1B4F 0214  CALL DIGITAL.OUT(SCORE): 'set port to normal
45 1B77 0214  NEXT I
1B91 0214  RETURN
1B95 0214  SET.RELAY:
1B98 0214  TEMP = XPOS(2,0)
1B84 0214  CALL SET.STROBE.RELAY(TEMP): 'in module PCI
50 1B84 0214  RETURN
1B84 0214  END IFASE

```

55

Request Jet Printer
Request Calibration

PAGE 11
07-16-84
12:26:37

IBM Personal Computer BASIC Compiler V2.00

Offset	Data	Source Line
18CA	024C	***** DATA USED BY THIS MODULE *****
18CA	024C	
18CA	024C	DATA:
18CF	024C	DATA "Frequency" E2,"10,000",10000,1,1,16
18D1	024C	DATA "Amplitude" 9,"100",150,0,1,19
18D3	024C	DATA "Stroke Delay" 45,"10,016.0",15199.5,.5,.5,16
18D5	024C	DATA "Pulse Width" ,"100",999,0,1,19
18D7	024C	DATA "Rise Time" ,"100",999,0,1,19
18D9	024C	DATA "Fall Time" ,"100",999,0,1,19
18DB	024C	DATA "Name","",0,0,0,0
18DD	024C	DATA "Concentration","",0,0,0,0
18DF	024C	DATA "Density","",0,0,0,0
18E1	024C	DATA "Viscosity","",0,0,0,0
18E3	024C	DATA "Surface Tension","",0,0,0,0
18E5	024C	DATA "", "", 0,0,0,0
18E7	024C	DATA "START", "", 0,0,0,0
18E9	024C	DATA "LOAD", "", 0,0,0,0
18EB	024C	DATA "SAVE", "", 0,0,0,0
18ED	024C	DATA "EXIT", "", 0,0,0,0
18EF	024C	DATA "", "", 0,0,0,0
18F1	024C	DATA "", "", 0,0,0,0
18F3	024C	
18F5	024C	TABLE:
18F7	024C	DATA 3,1,210
18F9	024C	DATA 3,70,210
18FB	024C	DATA 3,19,210
18FD	024C	DATA 3,80,191
18FF	024C	DATA 3,1,191
1C00	024C	DATA 3,20,206
1C02	024C	DATA 3,19,206
1C04	024C	DATA 3,10,191
1C06	024C	DATA 19,1,192
1C08	024C	DATA 19,20,200
1C0A	024C	DATA 19,19,200
1C0C	024C	DATA 19,00,217
1C0E	024C	
1C10	024C	
1C12	024C	END SUB
1C14	024C	
1C16	024C	
1C18	024C	
1C1A	024C	
1C1C	024C	
1C1E	024C	
1C20	024C	
1C22	024C	
1C24	024C	
1C26	024C	
1C28	024C	
1C2A	024C	
1C2C	024C	
1C2E	024C	
1C30	024C	
1C32	024C	
1C34	024C	
1C36	024C	
1C38	024C	
1C3A	024C	
1C3C	024C	
1C3E	024C	
1C40	024C	
1C42	024C	
1C44	024C	
1C46	024C	
1C48	024C	
1C4A	024C	
1C4C	024C	
1C4E	024C	
1C50	024C	
1C52	024C	
1C54	024C	
1C56	024C	
1C58	024C	
1C5A	024C	
1C5C	024C	
1C5E	024C	
1C60	024C	
1C62	024C	
1C64	024C	
1C66	024C	
1C68	024C	
1C6A	024C	
1C6C	024C	
1C6E	024C	
1C70	024C	
1C72	024C	
1C74	024C	
1C76	024C	
1C78	024C	
1C7A	024C	
1C7C	024C	
1C7E	024C	
1C80	024C	
1C82	024C	
1C84	024C	
1C86	024C	
1C88	024C	
1C8A	024C	
1C8C	024C	
1C8E	024C	
1C90	024C	
1C92	024C	
1C94	024C	
1C96	024C	
1C98	024C	
1C9A	024C	
1C9C	024C	
1C9E	024C	
1CA0	024C	
1CA2	024C	
1CA4	024C	
1CA6	024C	
1CA8	024C	
1CAA	024C	
1CAC	024C	
1CAE	024C	
1CB0	024C	
1CB2	024C	
1CB4	024C	
1CB6	024C	
1CB8	024C	
1CBA	024C	
1CBC	024C	
1CCE	024C	
1CD0	024C	
1CD2	024C	
1CD4	024C	
1CD6	024C	
1CD8	024C	
1CDA	024C	
1CDC	024C	
1CDE	024C	
1CDF	024C	
1CE0	024C	
1CE2	024C	
1CE4	024C	
1CE6	024C	
1CE8	024C	
1CEA	024C	
1CEC	024C	
1CEE	024C	
1CF0	024C	
1CF2	024C	
1CF4	024C	
1CF6	024C	
1CF8	024C	
1CFA	024C	
1CFB	024C	
1CFC	024C	
1CFD	024C	
1CFE	024C	
1CFF	024C	
1D00	024C	
1D02	024C	
1D04	024C	
1D06	024C	
1D08	024C	
1D0A	024C	
1D0C	024C	
1D0E	024C	
1D10	024C	
1D12	024C	
1D14	024C	
1D16	024C	
1D18	024C	
1D1A	024C	
1D1C	024C	
1D1E	024C	
1D20	024C	
1D22	024C	
1D24	024C	
1D26	024C	
1D28	024C	
1D2A	024C	
1D2C	024C	
1D2E	024C	
1D30	024C	
1D32	024C	
1D34	024C	
1D36	024C	
1D38	024C	
1D3A	024C	
1D3C	024C	
1D3E	024C	
1D40	024C	
1D42	024C	
1D44	024C	
1D46	024C	
1D48	024C	
1D4A	024C	
1D4C	024C	
1D4E	024C	
1D50	024C	
1D52	024C	
1D54	024C	
1D56	024C	
1D58	024C	
1D5A	024C	
1D5C	024C	
1D5E	024C	
1D60	024C	
1D62	024C	
1D64	024C	
1D66	024C	
1D68	024C	
1D6A	024C	
1D6C	024C	
1D6E	024C	
1D70	024C	
1D72	024C	
1D74	024C	
1D76	024C	
1D78	024C	
1D7A	024C	
1D7C	024C	
1D7E	024C	
1D80	024C	
1D82	024C	
1D84	024C	
1D86	024C	
1D88	024C	
1D8A	024C	
1D8C	024C	
1D8E	024C	
1D90	024C	
1D92	024C	
1D94	024C	
1D96	024C	
1D98	024C	
1D9A	024C	
1D9C	024C	
1D9E	024C	
1DA0	024C	
1DA2	024C	
1DA4	024C	
1DA6	024C	
1DA8	024C	
1DAA	024C	
1DAC	024C	
1DAE	024C	
1DB0	024C	
1DB2	024C	
1DB4	024C	
1DB6	024C	
1DB8	024C	
1DBA	024C	
1DBC	024C	
1DBE	024C	
1DC0	024C	
1DC2	024C	
1DC4	024C	
1DC6	024C	
1DC8	024C	
1DCA	024C	
1DCC	024C	
1DCE	024C	
1DD0	024C	
1DD2	024C	
1DD4	024C	
1DD6	024C	
1DD8	024C	
1DDA	024C	
1DDC	024C	
1DDE	024C	
1DE0	024C	
1DE2	024C	
1DE4	024C	
1DE6	024C	
1DE8	024C	
1DEA	024C	
1DEC	024C	
1DEE	024C	
1DF0	024C	
1DF2	024C	
1DF4	024C	
1DF6	024C	
1DF8	024C	
1DFA	024C	
1DFB	024C	
1DFC	024C	
1DFD	024C	
1DFE	024C	
1DFB	024C	
1DFF	024C	
1E00	024C	
1E02	024C	
1E04	024C	
1E06	024C	
1E08	024C	
1E0A	024C	
1E0C	024C	
1E0E	024C	
1E10	024C	
1E12	024C	
1E14	024C	
1E16	024C	
1E18	024C	
1E1A	024C	
1E1C	024C	
1E1E	024C	
1E20	024C	
1E22	024C	
1E24	024C	
1E26	024C	
1E28	024C	
1E2A	024C	
1E2C	024C	
1E2E	024C	
1E30	024C	
1E32	024C	
1E34	024C	
1E36	024C	
1E38	024C	
1E3A	024C	
1E3C	024C	
1E3E	024C	
1E40	024C	
1E42	024C	
1E44	024C	
1E46	024C	
1E48	024C	
1E4A	024C	
1E4C	024C	
1E4E	024C	
1E50	024C	
1E52	024C	
1E54	024C	
1E56	024C	
1E58	024C	
1E5A	024C	
1E5C	024C	
1E5E	024C	
1E60	024C	
1E62	024C	
1E64	024C	
1E66	024C	
1E68	024C	
1E6A	024C	
1E6C	024C	
1E6E	024C	
1E70	024C	
1E72	024C	
1E74	024C	
1E76	024C	
1E78	024C	
1E7A	024C	
1E7C	024C	
1E7E	024C	
1E80	024C	
1E82	024C	
1E84	024C	
1E86	024C	
1E88	024C	
1E8A	024C	
1E8C	024C	
1E8E	024C	
1E90	024C	
1E92	024C	
1E94	024C	
1E96	024C	
1E98	024C	
1E9A	024C	
1E9C	024C	
1E9E	024C	
1EA0	024C	
1EA2	024C	
1EA4	024C	
1EA6	024C	
1EA8		

Reagent Jet Printer
Pattern Entry/Modification

PAGE 1
07-05-86
10:46:13

```

Offset  Data  Source Line  IBM Personal Computer BASIC Compiler V2.00

      0030 0006  REM TITLE: 'Reagent Jet Printer' $SUBTITLE: 'Pattern Entry/Modif
      0030 0006  ication'
      0030 0006  'MODULE - 'PATENT' Pattern creation, modification, and filing
      0030 0006  '
      0030 0006  '
      0030 0006  'AUTHOR - M. A. Enevold
      0030 0006  '
      0030 0006  'COPYRIGHT (C) 1985 ABBOTT LABORATORIES
      0030 0006  '
      0030 0006  'REVISION - 1.2 03-10-86 NAE Remove Mouse inputs
      0030 0006  '          1.1 02-20-86 NAE Add 80 pattern limit to save
      0030 0006  '          1.0 01-13-86 NAE Creation of initial code
      0030 0006  '
      0030 0006  'SYSTEM - This code can only be compiled by the BASCOM
      0030 0006  '          COMPILER, it will not run under the INTERPRETER!!
      0030 0006  '
      0030 0006  'DESCRIPTION:
      0030 0006  '          This module allows the user to LOAD, SAVE, DIRECTORY, O
      0030 0006  RAY and
      0030 0006  '          enter repeat count and other parameters for a pattern t
      0030 0006  o be printed.
      0030 0006  '          The low-resolution graphics mode is selected and a menu
      0030 0006  is displayed
      0030 0006  '          across the bottom of the screen. Using arrow keys
      0030 0006  '          point to the action to be taken and then invoke that ac
      0030 0006  tion with the
      0030 0006  '          Enter key. In the GRAY mode, another menu is
      0030 0006  '          displayed which allows the user to select from LINE, RE
      0030 0006  CTangle,
      0030 0006  '          Solid RECTangle, or CIRCLE pattern elements.
      0030 0006  '
      0030 0006  'DATA DICTIONARY
      0030 0006  '          SCNDATL(30,5) 51 Row (Elements) by 6 Column array f
      0030 0006  or storing pattern elements
      0030 0006  '          CURSOR(9) Storage for cursor graphics icon
      0030 0006  '          MENUS(6) Up to 7 menu names can be saved here
      0030 0006  '          ELNUMX Count of number of elements in a patt
      0030 0006  ern
      0030 0006  '          TX TX Current location of graphics cursor
      0030 0006  '          GRID Value of one dot space on the screen
      0030 0006  (default is 0.005")
      0030 0006  '          ROWZ COLZ Location to print instructions
      0030 0006  '          AS Storage for single key-strokes or inp
      0030 0006  ut strings
      0030 0006  '          MENUMXN Which menu is being displayed (1 or 2
      0030 0006  )
      0030 0006  '          ITEM Pointer to which menu item is highlig
      0030 0006  hted (0 - 6)
      0030 0006  '          REPEATZ Number of times pattern is to be repe
      0030 0006  ated when printed
      0030 0006  '          IDFF YOFF X and Y axis distance between the pri
      0030 0006  nting of repeated patterns
      0030 0006  '          ROWSP COLSP Row and Column spacing for printing a
      0030 0006  multiple sets of patterns

```

6

10

15

Reagent Jet Printer
Pattern Entry/Modification

PAGE 2
07-05-86
10:46:13

Offset Data Source Line IBM Personal Computer BASIC Compiler V2.00

20

0030 0004 * PATDIRZ - Number of patterns stored in
the pattern directory PATDIR.RTP

0030 0006 * DRDWT DCOLL Row and Column location to display di
rectory entries

0030 0006 * NAMES Pattern name to be LOADED or SAVED to
directory

25

0030 0006 * IZ JZ Counters used to LOAD or SAVE the ele
ment data from/to pattern data file

0030 0006 * FILES Name of pattern data file

0030 0006 * TEMPL Which type of element is being drawn.

30

0030 0006 * 1 = Line 2 = Rectangle

0030 0006 * 3 = Solid Rectangle 4 = Circle

0030 0006 * FLAGZ Same as TEMPL above

0030 0006 * STARTXSS: ENDXSS: Message display for startpoint and en
dpoint of element entry

35

0030 0006 * IIZ YIZ Starting cursor position for
element being drawn

0030 0006 * DIZ DYI Delta I and Y values used to
re-position cursor after arrow key

40

0030 0006 * MAXITER The highest number item in th
e current menu display

0030 0006 * IS IE Starting and ending I position of the
menu highlighting blue box

0030 0006 * RADIUSI The calculated radius of a ci
rcle to be displayed

45

0030 0006 REM SPACE

60

85

Reagent Jet Printer
Pattern Entry/Modification

PAGE 3

07-05-86

10:46:13

Offset	Data	Source Line	IBM Personal Computer BASIC Compiler V2.00
0030	0006	SUB PATENTRY STATIC	
0047	0006		
0047	0006	WIDTH 40:SCREEN 1:CLS	
005F	0006	DIM SCNDAT\$(50,5),CURSOR\$(9),MENU\$(6)	
0060	029A	ELMUTZ = 0:IT=0:YT=0:GRID = 0.005	
007F	02A4		
007F	02A4	LINE (0,0)-(6,6),,B	
00A1	02A4	LINE (0,3)-(6,3),,B	
00C3	02A4	LINE (3,0)-(3,6),,B	
00E9	02A4	PRESET (3,3)	
00F3	02A4	GET (0,0)-(6,6),CURSOR	
0116	02A4	CLS	
011D	02A4		
011D	02A4	LINE (0,0)-(319,190),,B	
0140	02A4		
0140	02A4	RESTORE INSTRU	
0147	02A4	FOR I=1 TO 4	
0151	02A4	READ ROW1,COL1,AS	
0164	02AC	LOCATE ROW1,COL1:PRINT AS;	
0180	02AC	NEXT I	
0198	02B0		
0198	02B0	FIRST:	
01A0	02B0	MENUMIN = 1	
01AA	02B4	GOSUB SUBMENU	
01B0	02B4		
01B0	02B4	ON ITER + 1 GOTO PATDIR, PATLOAD, PATSAVE, PATDRAN, REP	
01CD	02B8	EAT, PATENT	
01CD	02B8	GOTO FIRST	
01D0	02B8		
01D0	02B8	REPEAT:	
01D5	02B8	GOSUB ITERWOTERASE: 'erase blue box around DIR	
01D8	02B8	LOCATE 25,1:PRINT SPACES(39); 'erase menu line	
01F8	02B8	LOCATE 25,1:INPUT;"Enter Repeat Count ";REPEAT	
0218	02BA	LOCATE 25,1:PRINT SPACES(39); 'erase menu line	
0233	02BA	LOCATE 25,1:INPUT;"Enter I Axis Offset ",IOFF	
0255	02BE	LOCATE 25,1:PRINT SPACES(39); 'erase menu line	
0272	02BE	LOCATE 25,1:INPUT;"Enter Y Axis Offset ",YOFF	
0292	02C2	GOTO FIRST	
0296	02C2	PATENT:	
0298	02C2	WIDTH 80:SCREEN 0:CLS	
02B2	02C2	EXIT SUB	
02B6	02C2	REM 17PAGE	

Resquest Jet Printer
Pattern Entry/Modification

PAGE 4
07-05-86
10:46:13

IBM Personal Computer BASIC Compiler V2.00

10

15

20

25

30

35

40

45

50

55

```

02B6 02C2 PATDIR:      'list directory of patterns
02B8 02C2      GOSUB INTEROIEPASE: 'erase blue box around DIR
02C1 02C2      LOCATE 25,1:PRINT SPACES(39); 'erase second line
02DE 02C2      OPEN "PATDIR.RJP" FOR INPUT AS #1: 'open directory
                                file
02EF 02C2      INPUT #1, PATNUM1: 'read number of patterns in dir
                                ectory
0301 02C4      LINE (1,1)-(318,189),0,0F: 'erase graphics tablet
0326 02C4      I = 0: 'set counter
0330 02C4      DISLOOP:
0335 02C4      I = I + 1: 'set for next value
0344 02C4      IF I > PATNUM1 THEN GOTO DIREXIT: 'test for done
035B 02C4      IF INT((I-1)/44) < (I-1)/44 THEN GOTO SHOWNEIT
0384 02C4      IF INT((I-1)/44) < 1 THEN GOTO SHOWNEIT
03A9 02C4      LOCATE 25,1:PRINT "More to Display. Continue ? (Y or N)
                                ";
03C3 02C4      GOSUB CORLOOP: 'wait for Y or N response
03C7 02C4      IF AS = "N" THEN GOTO DIREXIT: 'if N then don't contin
                                ue
03DC 02C4      LINE (1,1)-(318,189),0,0F: 'erase graphics tablet
03DE 02C4      SHOWNEIT:
0406 02C4      DROW1 = ((I - 1) MOD 22) + 2: 'calculate row for disp
                                lay
0422 02C4      DCOL1 = 4: 'set column to 4
0429 02C4      IF ((I - 1) MOD 44) > 21 THEN DCOL1 = 23: 'reset column
                                if necessary
044C 02C4      LINE INPUT #1, AS: 'read next name from directory
0459 02C4      LOCATE DROW1,DCOL1:PRINT AS; 'PRINT NAME
0475 02C4      GOTO DISLOOP
0479 02C4      DIREXIT:
047E 02C4      CLOSE #1: 'terminate access to PATDIR.RJP
0485 02C4      GOTO FIRST
0489 02C4      REM SPASE

```

```
Offset  Addr  Source Line
0489  0202  PATLOAD:
048E  0202  GOSUB ITENGOIERASE: 'erase blue box around DIR
0494  0202  OPEN "PATDIR.RJP" FOR INPUT AS #1
04A5  0202  INPUT #1,PATMUMI: 'read number of patterns in dir
10 04B7  0202  GOSUB GETNAME: 'prompt for and input pattern name
    'name
04B9  0202  LINE (1,1)-(318,189),0,BF: 'erase graphics tablet
04E2  0202
04E2  0202  GOSUB SEARCH
15 04E8  0202
04E8  0202  IF IZ < (PATMUMI + 1) THEN GOTO FOUND
04FC  0202  LOCATE 10,16-(LEN(Names)/2):PRINT Names; 'not Found';
0531  0202  LOCATE 12,14:PRINT "Strike Any Key"
054B  0202  GOSUB ANYKEY: 'wait for a keyhit
20 0551  0202  GOTO FIRST
0555  0202
0555  0202  FOUND:
055A  0202  FILES = RIGHTS(STR$(IZ),LEN(STR$(IZ))-1) + "PAT.RJP"
057E  0202  OPEN FILES FOR INPUT AS #1: 'set pattern data file
25 for read
058F  0202  INPUT #1,ELMUMI: 'read number of elements in pat
    term
05A1  0202  INPUT #1,GRID: 'read grid size
05B3  0202  INPUT #1,REPEAT: 'read repeat count
30 05C5  0202  INPUT #1,XOFF: 'read x axis offset for repeat
05D7  0202  INPUT #1,YOFF: 'read y axis offset for repeat
05E9  0202
05E9  0202  FOR IZ = 0 TO ELMUMI - 1
05F7  0202  FOR JZ = 0 TO 5
35 05FD  0202  INPUT #1,SCREEN$(IZ,JZ): 'read file into screen
    array
0621  0202  NEXT JZ
0631  0202  NEXT IZ
0643  0202  CLOSE #1: 'done with data file
40 064A  0202
064A  0202  OPEN "PATDEF.RJP" FOR OUTPUT AS #1
065C  0202  PRINT #1,FILES: 'save filename in default file
45 066C  0202  PRINT #1,NAMES: 'save the directory names as well
067C  0202  CLOSE #1
0683  0202
0683  0202  GOTO REDRAW
50 0687  0202
0687  0202  SEARCH:
068C  0202  IZ = 1: 'set entry pointer
0693  0202  SLOOP:
0698  0202  LINE INPUT #1,AS: 'read next pattern name from dir
65 06A5  0202  IF AS = NAMES THEN GOTO SEARCH.END: 'compare name with dir entry
06B8  0202  IZ = IZ + 1
06C1  0202  IF IZ < (PATMUMI + 1) THEN GOTO SLOOP: 'check for done
06D4  0202  SEARCH.END:
```


6

10

15

20

25

Reagent Jet Printer
Pattern Entry/Modification

PAGE 6
07-05-86
10:46:13

Offset Data Source Line IEM Personal Computer BASIC Compiler V2.00

30

0609 0226 CLOSE #1: 'not found so close file and display me
ssage

06E0 0226 RETURN

06E4 0226

06E4 0226 REM SPAGE

35

40

45

50

55

Reagent Jet Printer
Pattern Entry/Modification

PAGE 7
07-05-86
10:46:13

Offset Data Source Line IBM Personal Computer BASIC Compiler V2.00

```

6      06E4 02D6 PATSAVE:
      06E7 02D6      GOSUB ITEMDELETE: 'erase blue box around DIR
      06EF 02D6      IF ELNUM1 = 0 THEN GOTO FIRST: 'no elements in pattern
      06FE 02D6      OPEN "PATDIR.RJP" FOR INPUT AS #1
10     070F 02D6      INPUT #1,PATNUM1
      0721 02E6      IF PATNUM1 < 80 THEN GOTO SAVE.PAT: 'directory full
                                at 80 patterns
      0730 02D6      CLOSE #1
      0737 02D6      LOCATE 25,1:PRINT SPACES(39);: 'erase bottom l
                                line
15     0754 02D6      LOCATE 25,1:PRINT "Directory is full (80 patterns max)"
                                ;
      076E 02D6      GOSUB ANYKEY:GOTO FIRST
      0778 02D6      SAVE.PAT:
20     077D 02D6      GOSUB GETNAME: 'prompt for and get pattern name
      0783 02D6      GOSUB SEARCH
      0789 02D6      IF IZ > PATNUM1 THEN GOTO ADD.NEW.PATTERN
      079A 02D6      LINE (1,1)-(318,189),0,BF: 'erase graphics tablet
      07BF 02D6      LOCATE 10,13-(LEN(NAME1)/2):PRINT NAME1;' already exist
25     s.";
      07F4 02D6      LOCATE 12,15:PRINT "Replace it?"
      080E 02D6      PATNUM1 = IZ
      0815 02D6      AS = ""
      081F 02D6      WHILE AS = ""
30     082E 02D6          AS = INKEY$
      0838 02D6      WEND
      083B 02D6      IF AS = "Y" OR AS = "y" THEN GOTO SAVE.PATTERN
      0864 02D6      GOTO FIRST
      0868 02D6
35     0868 02D6      ADD.NEW.PATTERN:
      086D 02D6      KILL "PATDIR.OLD": 'delete old backup directory
      0874 02D6      NAME "PATDIR.RJP" AS "PATDIR.OLD": 'save old direc
                                tory
40     087E 02D6      OPEN "PATDIR.OLD" FOR INPUT AS #1
      088F 02D6      OPEN "PATDIR.RJP" FOR OUTPUT AS #2: 'set up new dir
      08A1 02D6      INPUT #1,PATNUM1: 'read number of dir entries
      08B3 02D6      PATNUM1 = PATNUM1 + 1: 'increase by 1
      08BC 02D6      WRITE #2,PATNUM1: 'save in new directory
      08CD 02D6      FOR I=1 TO PATNUM1 - 1
45     08E6 02D6          LINE INPUT #1,AS: 'read entry from old dir
      08F3 02D6          PRINT #2,AS: 'write entry in new directory
      0903 02D6      NEXT I
      091E 02D6      PRINT #2,NAME1: 'write new entry to new directo
                                ry
50     092E 02D6      CLOSE #1:CLOSE #2: 'done with directory
      093C 02D6      SAVE.PATTERN:
      0941 02D6      FILES = RIGHTS(STR$(PATNUM1),LEN(STR$(PATNUM1))-1) + "P
                                AT.RJP"
35     0963 02D6      OPEN FILES FOR OUTPUT AS #1: 'create new pattern dat
                                a file
      0977 02D6      WRITE #1,ELNUM1: 'store number of elements
      0988 02D6      WRITE #1,GRID: 'store grid dimension
      0998 02D6      WRITE #1,REPEAT: 'store repeat count
      09A9 02D6      WRITE #1,IOFF: 'store x axis offset for repeat

```

6

10

15

20

Reagent Jet Printer
Pattern Entry/Modification

PAGE 8

07-05-96

10:46:13

Offset Data Source Line

IBM Personal Computer BASIC Compiler V2.00

25

```

0989 0200      WRITE #1,YOFF:      'store y axis offset for repeat
09C7 0200      FOR J2 = 0 TO ELEMT - 1
09D7 0200          FOR J1 = 0 TO 5
09DD 0200              WRITE #1,SENDAT1(J2,J1):      'write screen a

```

30

```

0A03 0200      PRINT #1,FILE:      'print to file
0A10 0200      NEXT J2
0A22 0200      CLOSE #1:      'done with data file
0A29 0200      OPEN "PATDEF.RJP" FOR OUTPUT AS #1
0A38 0200      PRINT #1,FILES:      'save filename in default file
0A4B 0200      PRINT #1,DIRS:      'save the directory name as well
0A5B 0200      CLOSE #1
0A62 0200      GOTO FIRST
0A66 0200      REM 17PAGE

```

40

45

50

55

Reagent Jet Printer
Pattern Entry/Modification

PAGE 9
07-05-86
10:46:13

Offset Data Source Line ICR Personal Computer BASIC Compiler V2.00

```

8      0A46 02DC PATNAM:
      0A48 02DC      GOSUB ITXG01ERASE
      0A71 02DC      LINE (1,1)-(319,189),0,0F:      'Erase graphics tablet
      0A96 02DC
10     0A96 02DC KEITEL:
      0A98 02DC      RESUME = 2
      0AAS 02DC      GOSUB SUMLEN
      0AAB 02DC
      0AAB 02DC      ON ITER + 1 GOTO ALINE, RECT, SRECT, ACIRCLE, REDRAW, 0
15     0AAB 02DC      ACTOP
      0AC8 02DC      GOTO KEITEL
      0ACB 02DC
      0ACB 02DC BACKUP:
      0AD0 02DC      GOSUB ITXG01ERASE
      0AD6 02DC      GOTO FIRST
20     0ADA 02DC
      0ADA 02DC ALINE:
      0ADF 02DC      TEMPI = 1
      0AE6 02DC      STARTSSG = 'STARTING ENDPOINT'
      0AF0 02DC      ENDSSG = 'ENDING ENDPOINT '
25     0AFA 02E6      GOTO ENTERELEMENT
      0AFE 02E6
      0AFE 02E6 RECT:
      0B03 02E6      TEMPI = 2
30     0B04 02E6      GOTO RECTSSG
      0B0E 02E6
      0B0E 02E6 SRECT:
      0B13 02E6      TEMPI = 3
      0B1A 02E6 RECTSG:
35     0B1F 02E6      STARTSSG = 'STARTING CORNER'
      0B29 02E6      ENDSSG = 'ENDING CORNER '
      0B33 02E6      GOTO ENTERELEMENT
      0B37 02E6
      0B37 02E6 ACIRCLE:
40     0B3C 02E6      TEMPI = 4
      0B43 02E6      STARTSSG = 'CENTER OF CIRCLE'
      0B4B 02E6      ENDSSG = 'POINT ON CIRCLE '
      0B57 02E6
      0B57 02E6 ENTERELEMENT:
45     0B5C 02E6      GOSUB ITXG01ERASE
      0B62 02E6      FLAG=0
      0B69 02E6      LOCATE 25,1:PRINT SPACES(39);
      0B86 02E6      LOCATE 25,1:PRINT STARTSSG;
      0B88 02E6      GOSUB DISPCURSOR
50     0B86 02E6 FIXSTART:
      0B8B 02E6      GOSUB KCURSECT
      0B8E 02E6      IF AS = CHR$(27) THEN GOTO ABORT
      0B98 02E6      IF AS = CHR$(13) THEN GOTO SETSTART
      0B9F 02E6      GOSUB CURSORMOVE
55     0BES 02E6      GOTO FIXSTART
      0BEE 02E6 ABORT:
      0BEC 02E6      GOSUB PLACECURSOR
      0BF3 02E6      GOTO KEITEL
      0BF7 02E6

```

Reagent Jet Printer
Pattern Entry/Modification

PAGE 10
07-02-86
10:46:13

Offset Data Source Line IEN Personal Computer BASIC Compiler V2.00

```

08F7 02EB SETSTART:
08FC 02EB LOCATE 25,1:PRINT ENDSUB:
0C16 02EB FLAGZ = TEMP1:11Z = 1Z:Y1Z = YZ
20 0C28 02EC IF FLAGZ = 4 THEN PSET (1Z+4,YZ+4)
0C33 02EC FINDEND:
0C5A 02EC GOSUB POUSEACT
0C60 02EC IF AS = CHR$(27) THEN GOTO CANCEL1
0C77 02EC IF AS = CHR$(13) THEN GOTO SAVEEL
25 0C8E 02EC GOSUB CURSCMOVE
0C94 02EC GOTO FINDEND
0C97 02EC CANCEL1:
0C9C 02EC GOSUB PLACECURSOR
0CA2 02EC ON FLAGZ GOSUB ER1, ER2, ER3, ER4
30 0CB3 02EC FLAGZ = 0
0CBA 02EC GOTO NEXTEL
0CBE 02EC SAVEEL:
0CE3 02EC GOSUB PLACECURSOR
0CC9 02EC IF FLAGZ = 4 THEN CIRCLE (11Z+4,Y1Z+4),SCR(1Z-11Z)*2+1
35 YZ-Y1Z)*2+1,,,1
0D32 02EC GOSUB CORRECT
0D38 02EC IF AS="N" THEN GOTO ACCRAW
0D48 02EC STOREEL:
0D50 02EC SCNDATZ(ELNUMZ,0) = FLAGZ
40 0D6A 02EC SCNDATZ(ELNUMZ,1) = 11Z
0D85 02EC SCNDATZ(ELNUMZ,2) = Y1Z
0DA0 02EC SCNDATZ(ELNUMZ,3) = 1Z
0DB8 02EC SCNDATZ(ELNUMZ,4) = YZ
0DD6 02EC SCNDATZ(ELNUMZ,5) = 0
45 0DEF 02EC ELNUMZ = ELNUMZ + 1
0DF8 02EC FLAGZ = 0
0EFF 02EC GOTO NEXTEL
0E03 02EC REM 17PAGE

```

Reagent Jet Printer
Pattern Entry/Modification

PAGE 11
37-05-86
16:46:13

```

Offset  Data  Source Line  IBM Personal Computer BASIC Compiler V2.00
8
0E03 02EC  REGNAM:
0E08 02EC  GOSUB ITENDOTERASE
0E0E 02EC  LINE(1,1)-1312,1891,0,0F
0E33 02EC  IF ELKUNT = 0 THEN GOTO NEXTEL
10 0E42 02EC
0E42 02EC  FOR I=0 TO ELKUNT-1
0E5B 02F0  ON SENDATL(1,0) GOSUB R01, R02, R03, R04
0E81 02F0  NEXT I
0E9C 02F0  GOTO NEXTEL
18 0EA0 02F0
0EA0 02F0  '***** Sub-routines called by main module *****
0EA0 02F0
0EA0 02F0  SUBMENU:
0EAS 02F0
20 0EAS 02F0  LOCATE 25,1:PRINT SPACES(39);
0EC2 02F0  ON MENUUM GOSUB MENU1, MENU2
0ED1 02F0
0ED1 02F0  FOR I=0 TO 6
0ED8 02F0  READ MENU(1)
25 0EF2 02F0  LOCATE 25,11+61+2:PRINT MENU(1);
0F23 02FC  NEXT I
0F46 02F0
0F46 02F0  READ MAXITER
0F4D 02F4  ITER = 0
30 0F57 02F4
0F57 02F4  NEXTEN:
0F5C 02F4  GOSUB NEXTENBOX
0F62 02F4
0F62 02F4  NEXTTEN:
35 0F67 02F4  GOSUB ITENDSEARCH
0F6D 02F4  IF AS = CHR$(13) THEN RETURN: ITER has correct value
0F84 02F4  IF LEN(AS) < 2 THEN GEEP:GOTO NEXTTEN
0F9A 02F4  IF ASC(MID$(AS,2,1)) = 75 THEN GOTO LEFTAR
0F86 02F4  IF ASC(MID$(AS,2,1)) = 77 THEN GOTO RIGHTAR
40 0FD2 02F4  GEEP:GOTO NEXTTEN
0FD9 02F4
0FD9 02F4  LEFTAR:
0FDE 02F4  IF ITER = 0 THEN GOTO NEXTTEN
0FEE 02F4  GOSUB ITENDOTERASE
45 0FF4 02F4  ITER = ITER - 1
1003 02F4  GOTO NEXTEN
1007 02F4
1007 02F4  RIGHTAR:
100C 02F4  IF ITER = MAXITER THEN GOTO NEXTTEN
50 101F 02F4  GOSUB ITENDOTERASE
1025 02F4  ITER = ITER + 1
1034 02F4  GOTO NEXTEN
1038 02F4
1038 02F4  MENU1:
55 103D 02F4  RESTORE R01
1044 02F4  RETURN
1048 02F4
1048 02F4  MENU2:
104D 02F4  RESTORE R02

```

Reagent Jet Printer
Pattern Entry/Modification

PAGE 12
07-05-86
10:46:13
IBM Personal Computer BASIC Compiler V2.00

Offset	Code	Source Line
1034	02F4	RETURN
1038	02F4	
1038	02F4	ITERSEARCH:
1039	02F4	AS = INKEY\$: IF AS <> "" THEN RETURN
1074	02F4	GOTO ITERSEARCH
1079	02F4	RETURN
1081	02F4	
1081	02F4	NEWITERGOS:
1086	02F4	IS = (ITER+40) + 7
109C	02F8	IE = (ITER+40) + 8 + LEN(LENUS(ITER)) + 8
1099	02FC	LINE (IS,191)-(IE,199),1,8
1101	02FC	RETURN
1105	02FC	
1105	02FC	ITERERASE:
110A	02FC	LINE (IS,191)-(IE,199),0,8
1131	02FC	RETURN
1133	02FC	
1135	02FC	PLACECURSOR:
113A	02FC	PUT (IX+1,YI+1),CURSOR1
1157	02FC	RETURN
1159	02FC	
1159	02FC	HOUSEACT:
1160	02FC	GOSUB ANYKEY
1166	02FC	DIZ = 0 : DYL = 0
1174	0300	IF AS = CHR\$(0) + CHR\$(72) THEN DYL = -1:RETURN
1190	0300	IF AS = CHR\$(0) + CHR\$(60) THEN DYL = 1:RETURN
11C6	0300	IF AS = CHR\$(0) + CHR\$(77) THEN DIZ = 1:RETURN
11EF	0300	IF AS = CHR\$(0) + CHR\$(75) THEN DIZ = -1:RETURN
1218	0300	IF AS = "8" THEN DYL = -20:RETURN
1232	0300	IF AS = "2" THEN DYL = 20:RETURN
124C	0300	IF AS = "4" THEN DIZ = -20:RETURN
1266	0300	IF AS = "6" THEN DIZ = 20:RETURN
1280	0300	IF AS = CHR\$(27) THEN RETURN
1297	0300	IF AS = CHR\$(13) THEN RETURN
12AE	0300	GOTO HOUSEACT
12B2	0300	
12B2	0300	CURSORMOVE:
12B7	0300	GOSUB PLACECURSOR
12B9	0300	ON FLAG1 GOSUB ER1, ER2, ER3, ER4
12CE	0300	IX = IX + DIZ : YI = YI + DYL
12E6	0300	IF IX < 0 THEN IX = 0
12F9	0300	IF IX > 311 THEN IX = 311
1300	0300	IF YI < 0 THEN YI = 0
1318	0300	IF YI > 182 THEN YI = 182
1330	0300	ON FLAG2 GOSUB DR1, DR2, DR3, DR4
1341	0300	GOSUB DISPCURSOR
1347	0300	RETURN
1348	0300	
1348	0300	CORRECT:
1350	0300	LOCATE 25,1:PRINT SPACE\$(39);
1360	0300	LOCATE 25,1:PRINT "IS THIS CORRECT? (Y or N) ";
1387	0300	CORLOOP:
138C	0300	GOSUB ANYKEY
1392	0300	IF AS = "y" OR AS = "Y" THEN AS = "Y":GOTO CORRECT

Offset	Data	Source Line	IBM Personal Computer BASIC Compiler V2.00
13C5	0300	IF AS = "n" OR AF = "n" THEN AS = "n":GOTO CORRECT	
13F8	0300	GOTO CORCORP	
13F8	0300	CORRECT:	
1400	0300	LOCATE 25,1:PRINT SPACES(39);	
1410	0300	RETURN	
1421	0300		
1421	0300	DISPCURSOR:	
1426	0300	GOSUB PLACECURSOR	
142C	0300	LOCATE 25,27:PRINT USING "+0.000";IX = GRID;	
1436	0300	PRINT " ,";	
1443	0300	PRINT USING "+0.000";YI = GRID;	
1450	0300	RETURN	
1484	0300		
1484	0300		
1484	0300	RD1:	
1489	0300	LINE(ISCNDATZ(I,1)+4,SCNDATZ(I,2)+4)-(ISCNDATZ(I,3)+4,SCNDATZ(I,4)+4)	
1522	0300	RETURN	
1526	0300		
1526	0300	RD2:	
152D	0300	LINE(ISCNDATZ(I,1)+4,SCNDATZ(I,2)+4)-(ISCNDATZ(I,3)+4,SCNDATZ(I,4)+4),,B	
15C4	0300	RETURN	
15C8	0300		
15C8	0300	RD3:	
15CD	0300	LINE(ISCNDATZ(I,1)+4,SCNDATZ(I,2)+4)-(ISCNDATZ(I,3)+4,SCNDATZ(I,4)+4),,BF	
1667	0300	RETURN	
1668	0300		
1668	0300	RD4:	
1670	0300	RADIUS1 = SQR((ISCNDATZ(I,3)-SCNDATZ(I,1))^2 + (SCNDATZ(I,4)-SCNDATZ(I,2))^2)	
16FF	0302	CIRCLE (SCNDATZ(I,1)+4,SCNDATZ(I,2)+4),RADIUS1,,,1	
175D	0302	RETURN	
1761	0302		
1761	0302	DR1:	
1766	0302	LINE (IX+4,YI+4)-(IX+4,YI+4)	
17AF	0302	RETURN	
17B3	0302		
17B3	0302	DR2:	
17B8	0302	LINE (IX+4,YI+4)-(IX+4,YI+4),,B	
1801	0302	RETURN	
1805	0302		
1805	0302	DR3:	
180A	0302	LINE (IX+4,YI+4)-(IX+4,YI+4),,BF	
1854	0302	RETURN	
1858	0302		
1858	0302	DR4:	
185D	0302	RETURN	
1861	-0302		
1861	0302	ER1:	
1866	0302	LINE (IX+4,YI+4)-(IX+4,YI+4),0	
18AF	0302	RETURN	
18B3	0302		



Reagent Jet Printer
Pattern Entry/Modification

PAGE 14
07-05-86
10:46:13

Offset Data Source Line IEM Personal Computer BASIC Compiler V2.00

```

10 1883 0302 E52:
1888 0302 LINE (X12+4,Y12+4)-(X2+4,Y2+4),0,B
1901 0302 RETURN
1905 0302
1905 0302 E53:
190A 0302 LINE (X12+4,Y12+4)-(X2+4,Y2+4),0,BF
1914 0302 RETURN
1918 0302
1918 0302 E54:
191D 0302 RETURN
1961 0302
20 1961 0302 ANYKEY:
1966 0302 AS = ""
1970 0302 WHILE AS = ""
1977 0302 AS = INKEY$
1989 0302 WEND
198C 0302 RETURN
25 1990 0302
1990 0302 GETNAME: 'prompt for and get filename
1995 0302 LOCATE 25,1:PRINT SPACE(39);
1995 0302 LOCATE 25,38:PRINT "<:"; 'boundary chevron
199C 0302 LOCATE 25,1:PRINT "Enter Pattern Name ";
30 19E6 0302 LINE INPUT; "",NAME$
19F4 0302 RETURN
19F8 0302
19F8 0302 ' Data fields used by this module
35 19F8 0302
19F8 0302 AN1:
19FD 0302 DATA "DIR","LOAD","SAVE","GRAM","REPT","EXIT","",5
19FF 0302
19FF 0302 AN2:
40 1A04 0302 DATA "LINE","RECT","CRECT","CIRCLE","REDRN","MAIN","",5
1A06 0302
1A06 0302 INSTRUCL:
1A0B 0302 DATA 8,16,"USE ARROWS"
1A0D 0302 DATA 10,9,"TO SELECT FROM THE MENU"
45 1A0F 0302 DATA 14,12,"USE THE ENTER KEY"
1A11 0302 DATA 16,10,"TO ACTIVATE SELECTION"
1A13 0302
1A13 0302 END SUB
1A1A 0302
60 21AF 0302

```

50426 Bytes Available
43373 Bytes Free

65 0 Warning Error(s)
0 Severe Error(s)

Offset	Data	Source Line
0000	0006	REM TITLE: 'Reagent Jet Printer' \$SUBTITLE: 'Burr-Brown PCI-20000 custom driver'
0030	0006	'MODULE - 'PCI' Driver for the PCI-20000 I/O and PULSE cards
0030	0006	'AUTHOR - M. S. Fairchild of Computing Architects Inc.
0030	0006	113 Fairfield Way
0030	0006	Bloomington, IL 60108
0030	0006	312/980-6777
0030	0006	'COPYRIGHT (C) 1985 ABBOTT LABORATORIES
0030	0006	'REVISION - 1.2 12-16-85 NSF Add digital I/O initialization, and output routine
0030	0006	' - 1.1 12-10-85 NSF Move counter module to position 2
0030	0006	' - 1.0 11-22-85 NSF Creation of initial code
0030	0006	'SYSTEM - This code can only be compiled by the BASCOM V2 COMPILER, it will not run under the INTERPRETER!!
0030	0006	'DESCRIPTION:
0030	0006	The PCI module is a group of routines used to access the BURR-Brown PCI-20000 board. The supplied software causes the Wordstar2000 software to malfunction and will not provide explicit on, off functions for the counters. Custom drivers will be added to provide all of the desired functions.
0030	0006	Address Register
0030	0006	\$H0000 Carrier I.D. / module present (R)
0030	0006	\$H0040 Module interrupt status (R)
0030	0006	\$H0060 Digital I/O port 0 (R/W)
0030	0006	\$H0080 Digital I/O port 1 (R/W)
0030	0006	\$H0082 Buffer direction and enable (R/W)
0030	0006	\$H0083 Control for ports 0 and 1 (W)
0030	0006	\$H00C0 Digital I/O port 2 (R/W)
0030	0006	\$H00C1 Digital I/O port 3 (R/W)
0030	0006	\$H00C3 Control for ports 2 and 3 (W)
0030	0006	\$H0200 Read module I.D. (1110 1010)
0030	0006	\$H0204 Rate generator low-order 16 bits (R)
0030	0006	\$H0205 Rate generator high-order 16 bits (R)
0030	0006	\$H0206 Counter 3 count register (R)
0030	0006	\$H0207 Rate generator/counter 3 control
0030	0006	\$H0208 Counter 0 count register (R)
0030	0006	\$H0209 Counter 1 count register (R)
0030	0006	\$H020A Counter 2 count register (R)
0030	0006	\$H020B Counter 0 - 2 control
0030	0006	\$H020C Counter gate control (1 enables, 0 disables)

8

10

Reagent Jet Printer
Burr-Brown PCL-20500 custom driver

PAGE 2

06-30-86

09:38:16

Offset Data Source Line IBM Personal Computer BASIC Compiler V2.00

15

bits:

Offset	Data	Source Line	bit	function
0030	0006	.	0	Rate generator gate
0030	0006	.	1	Rate generator gate
0030	0006	.	2	Counter 0 gate
0030	0006	.	3	Counter 1 gate
0030	0006	.	4	Counter 2 gate
0030	0006	.	5	Counter 3 gate
0030	0006	.	6	Not used
0030	0006	.	7	Not used

20

25

DATA DICTIONARY

0030 0006

0030 0006

0030 0006

30

0030 0006

COUNT - Divisor to 2MHz rate to give desired frequency or time

COUNTX - High order 16 bits of a 32 bit divisor

0030 0006

0030 0006

0030 0006

35

0030 0006

0030 0006

0030 0006

0030 0006

COUNTX - Low order 16 bits of a 32 bit divisor

LSBX - Lower 8 bits of a 16 bit divisor

MSBX - Upper 8 bits of a 16 bit divisor

Main line code

The main line code is never executed. It's sole purpose is to

40

0030 0006

declare shared the variables that will be used in the subroutines

0030 0006

0030 0006

0030 0006

so that they will all be defined and hold their values.

45

0030 0006

0030 0006

0030 0006

0030 0006

MAIN:

DIM SHARED COUNT,COUNTX,COUNTX,LSBX,MSBX

MAINLOOP:

GOTO MAINLOOP

50

004C 0012

REM SPACE

55

Reagent Jet Printer
Burr-Brown FGI-20000 custom driver

PAGE 3
06-30-86
08:38:16

```

Offset  Data  Source Line  I86 Personal Computer BASIC Compiler V2.00

004C 0012 'SUBROUTINE - PCI.EXIT
004C 0012
004C 0012 'DESCRIPTION:
004C 0012 ' The PCI.EXIT subroutine initializes the PCI hardware.
004C 0012
004C 0012 ' PCI.EXIT STATIC
0053 0012
0053 0012 'DEF SEG = &H0000: 'Point segment to PCI-20000 board
005A 0012
005A 0012 'POKE &H020C,&H03: 'Disable all software enabled counter
0063 0012
0063 0012 ' Configure rate generator to 2 Khz
0063 0012
0063 0012 'POKE &H0207,&H34: 'Set low rate counter to mode 2
0069 0012 'POKE &H0207,&H74: 'Set high rate counter to mode 2
0077 0012 'POKE &H0204,&H02: 'Load low rate counter with 16 bits 0
0081 0012
0081 0012 'POKE &H0204,&H00
008A 0012 'POKE &H020C,&H02: 'Load high rate counter with 16 bits
0094 0012
0094 0012 'POKE &H020C,&H00
0099 0012 'POKE &H020C,&H03: 'Enable rate counters
00A7 0012
00A7 0012 ' Configure dot rate counters (default to 5 Khz)
00A7 0012
00A7 0012 'POKE &H020B,&H34: 'Set low dot counter (0) to mode 2
00B1 0012 'POKE &H020B,&H74: 'Set high dot counter (1) to mode 2
00B8 0012 'POKE &H020C,&H04: 'Load low rate counter with 16 bits 0
00C5 0012
00C5 0012 'POKE &H020B,&H00
00CE 0012 'POKE &H020B,&H64: 'Load high rate counter with 16 bits
00D8 0012
00D8 0012 'POKE &H0209,&H00
00E1 0012
00E1 0012 ' Configure dot pulse with one shot (default to 13 usec)
00E1 0012
00E1 0012 'POKE &H0203,&H72: 'Set dot pulse with oneshot (2) to on
00ED 0012
00ED 0012 'POKE &H020A,&H1A: 'Load oneshot with 16 bits of 26
00F3 0012 'POKE &H020A,&H00
00FE 0012
00FE 0012 ' Configure shifted strobe pulse one shot (default to .5 usec)
00FE 0012
00FE 0012 'POKE &H0207,&H72: 'Set shifted strobe onshot (3) to on
0108 0012
0108 0012 'POKE &H0206,&H01: 'Load oneshot with 16 bits of 1
0112 0012 'POKE &H0206,&H00
0118 0012
0118 0012 ' Configure port 0 to output and port 1 to input
0118 0012
0118 0012 'POKE &H0083,&H072: ' Set up I/O chip
0123 0012 'POKE &H0082,&H04: ' Set up direction and enable buffers
012F 0012 'POKE &H0080,&H00: ' Dissable print head

```

5

10

15

20

25

30

35

40

45

50

55

Reagent Jet Printer
 Burr-Brown PCM-05000 custom driver

PAGE 4
 06-30-86
 08:38:16

Offset Data Source Line IZM Personal Computer BASIC Compiler V2.00

```

0136 0012      END SUB
013F 0012
20 013F 0012  REM #PAGEIF:12
013F 0012 'SUBROUTINE - DOT.ON
013F 0012 '
013F 0012 'DESCRIPTION:
25 013F 0012 ' The DOT.ON subroutine enables the dot frequency counter
    s.
013F 0012
013F 0012 SUB DOT.ON STATIC
0146 0012
30 0146 0012 POKE LH020C,LH0F: 'Enable dot counters and rate generat
    or
0150 0012
0150 0012      END SUB
0157 0012
0157 0012 REM #PAGEIF:12
35 0157 0012 'SUBROUTINE - DOT.OFF
0157 0012 '
0157 0012 'DESCRIPTION:
0157 0012 ' The DOT.OFF subroutine disables the dot counters
40 0157 0012
0157 0012 SUB DOT.OFF STATIC
015E 0012
015E 0012 POKE LH020C,LH03: 'Disable dot counters and enable rate
    generator
45 0168 0012
0168 0012      END SUB
016F 0012
016F 0012 REM #PAGEIF:19

```

Reagent Jet Printer
Burr-Brown PCI-20000 custom driver

PAGE 5
06-30-86
08:38:16

Offset	Data	Source Line	IBM Personal Computer BASIC Compiler V2.00
016F	0012	'SUBROUTINE	- SET.DOT.RATE
016F	0012	.	
016F	0012	'DESCRIPTION:	
016F	0012	' The SET.DOT.RATE subroutine loads the dot rate counters	
016F	0012	' with the desired dot frequency. Allowed range is 10,000 to 1	
		Hz.	
016F	0012	' The FREQ parameter is a real number in Hz.	
016F	0012		
016F	0012	SUB SET.DOT.RATE(FREQ) STATIC	
0176	0012		
0176	0012	' Limit frequency to in range	
0176	0012		
0176	0012	IF FREQ < 1 THEN FREQ = 1	
018F	0012	IF FREQ > 10000 THEN FREQ = 10000	
01A8	0012		
01A8	0012	' Convert to count and check for 16 bit count or 32 bit count	
01A8	0012		
01A8	0012	COUNT = Z66 / FREQ	
01B8	0012	IF COUNT < 65536 THEN GOTO DIVIDE16 ELSE GOTO DIVIDE32	
01CF	0012		
01CF	0012	' Process count of 32 bits	
01CF	0012		
01CF	0012	DIVIDE32:	
01D0	0012	COUNTL2 = INT(COUNT/32768) + 1: 'Stage lower count	
01F0	0012	COUNTM2 = INT(COUNT/COUNTL2): 'Form upper count	
0208	0012	GOTO SET.COUNT	
020F	0012		
020F	0012	' Process count of 16 bits	
020F	0012		
020F	0012	DIVIDE16:	
0214	0012	COUNTL2 = 2	
0218	0012	COUNTM2 = INT(COUNT/2)	
0232	0012	GOTO SET.COUNT	
0236	0012		
0236	0012	' Send the derived counts out to the counters	
0236	0012		
0236	0012	SET.COUNT:	
0237	0012	LSB2 = COUNTL2 MOD 256: ' Send out low 16 bits	
0248	0012	MSB2 = INT(COUNTL2 / 256)	
02A3	0012	POKE 4M0208,LSB2	
0273	0012	POKE 4M0208,MSB2	
0283	0012		
0283	0012	LSB2 = COUNTM2 MOD 256: ' Send out high 16 bits	
0291	0012	MSB2 = INT(COUNTM2 / 256)	
02AC	0012	POKE 4M0209,LSB2	
02BC	0012	POKE 4M0209,MSB2	
02CC	0012		
02CC	0012	END SUB	
02B3	0012		
02B3	0012	REM SPAGEIF:27	

Reagent Jet Printer
Burr-Brown FCI-20000 custom driver

PAGE 6
06-30-86
08:22:16

```

15      Offset  Data  Source Line  ISA Personal Computer BASIC Compiler V2.00

      02D3  0012  'SUBROUTINE  - SET.DOT.WIDTH
      02D3  0012  '
      02D3  0012  'DESCRIPTION:
20      02D3  0012  '   The SET.DOT.WIDTH subroutine loads the dot width one sh
      '   at
      02D3  0012  '   with the desired dot pulse width. Allowed range is .5 to 16,0
      '   00 usec.
      02D3  0012  '   The dwidth parameter is a real number in usec.
25      02D3  0012  '
      02D3  0012  SUB SET.DOT.WIDTH(DWIDTH) STATIC
      02DA  0012  '
      02DA  0012  ' Limit width to in range
      02DA  0012  '
30      02DA  0012  IF DWIDTH < .5 THEN DWIDTH = .5
      02DA  0012  IF DWIDTH > 16000 THEN DWIDTH = 16000
      02F3  0012  '
      030C  0012  ' Convert to count
      030C  0012  '
35      030C  0012  COUNT = DWIDTH / .5
      031A  0012  '
      031A  0012  ' Send the derived count out to the counter
      031A  0012  '
40      031A  0012  LSB2 = INT(COUNT MOD 256): ' Send out 16 bits
      0331  0012  MSB2 = INT(COUNT / 256)
      0348  0012  POKE &H020A,LSB2
      0338  0012  POKE &H020A,MSB2
      0348  0012  '
45      0348  0012  END SUB
      034F  0012  '
      034F  0012  END IFASEIF:27

```

```

6      Offset  Data  Source Line  IBM Personal Computer BASIC Compiler V2.00

036F 0012 'SUBROUTINE - SET.STROBE.DELAY
036F 0012 '
036F 0012 'DESCRIPTION:
10 036F 0012 ' The SET.STROBE.DELAY subroutine loads the strobe delay
one shot
036F 0012 ' with the desired strobe delay time. Allowed range is .5 to 16
,000 usec.
036F 0012 ' The delay parameter is a real number in usec.
15 036F 0012
036F 0012 SUB SET.STROBE.DELAY(DELAY) STATIC
0376 0012
0376 0012 ' Limit delay to in range
0376 0012
20 0376 0012 IF DELAY < .5 THEN DELAY = .5
037F 0012 IF DELAY > 16000 THEN DELAY = 16000
03A8 0012
03A8 0012 ' Convert to count
03A8 0012
25 03A8 0012 COUNT = DELAY / .5
03B6 0012
03B6 0012 ' Send the derived count out to the counter
03B6 0012
03B6 0012 LSB% = INT(COUNT MOD 256): ' Send out 16 bits
30 03CD 0012 MSB% = INT(COUNT / 256)
03E4 0012 POKE 40206,LSB%
03F4 0012 POKE 40206,MSB%
0404 0012
0404 0012 END SUB
35 040B 0012
040B 0012 REM %PAGEIF:16
040B 0012 'SUBROUTINE - DIGITAL.OUT
040B 0012 '
040B 0012 'DESCRIPTION:
40 040B 0012 ' The DIGITAL.OUT subroutine sends the passed integer to
the output
040B 0012 ' port 0.
040B 0012
040B 0012 SUB DIGITAL.OUT(BYTE%) STATIC
45 0412 0012
0412 0012 ' Send the byte to the port
0412 0012
0412 0012 POKE 40080,BYTE%
0423 0012
50 0423 0012 END SUB
042A 0012
057F 0012

```

50426 Bytes Available
48723 Bytes Free

0 Warning Error(s)
0 Severe Error(s)

Reagent Jet Printer
Pattern Printing

PAGE
00-1
00:0

IBM Personal Computer BASIC Compiler V

```

10  Offset  Data  Source Line
      0030 0004 FOR #TITLE: 'Reagent Jet Printer' #SUBTITLE: 'Pattern Printing' #LINE#122
      0030 0004 #TITLE - 'PATTERN'
      0030 0004
      0030 0004 #AUTHOR - E. A. Crawford
      0030 0004
15  0030 0004 #INSTITUTE (C) 1985 MICROFILM LABORATORIES
      0030 0004
      0030 0004 #REVISED - 2.0 07-02-84 BAE Modified for Microfilm Printhead
      0030 0004 - 1.1 03-07-84 BAE Added notes and final touches
      0030 0004 - 1.0 02-03-84 BAE Creation of initial code
      0030 0004
20  0030 0004 #SYSTEM - This code can only be compiled by the BASCOM
      0030 0004 #COMPILER, it will not run under the INTERPRETER!!
      0030 0004
      0030 0004 #DESCRIPTION:
      0030 0004 The printing module displays a menu in 3 columns of 4 rows each. The first
25  0030 0004 column has data from the default reagent profile. The second column has
      0030 0004 data from the default pattern file. The third column has standard printing
      0030 0004 data. The four arrow keys allow different menu items to be highlighted and
      0030 0004 the values can be changed with the + or - keys or by entering the new number
      0030 0004 followed by Enter. P will cause the pattern to be printed, S will select the
      0030 0004 notepad, and E will exit to the main program. On the notepad, any single line
30  0030 0004 entered here will be sent to the printer. A null line exits the notepad.
      0030 0004
      0030 0004 #DATA DICTIONARY
      0030 0004 #MENU Which menu item is highlighted (0-17)
      0030 0004 #DIFF Where to save menu highlight in response to arrow key
      0030 0004 #TYPE What key has been pressed during menu scan
      0030 0004 #ELEMNT Number of elements in current pattern
35  0030 0004 #SELECT(12,3) Array for storing elements in current pattern
      0030 0004 #REPEAT Counter for repeat printing the pattern
      0030 0004 #CTR Counter for stepping through the pattern array during printing
      0030 0004 #RADIUS Radius of circle during printing
      0030 0004 #X Y Offsets for start row/column position
40  0030 0004 #REP1 REP2 Repeat distances for repeat printing of patterns
      0030 0004 #S1 S2 Starting X and Y positions for solid rectangles
      0030 0004 #E1 E2 Ending X and Y positions for solid rectangles
      0030 0004 #I1 I2 Counters used for reading pattern files into the array
      0030 0004 #TEMP Register for misc. integers
      0030 0004 #NOTELINE Pointer to which line is active in the notepad
45  0030 0004 #MENU(17,1) Array of strings used to display menu items
      0030 0004 #M Single keystroke input destination
      0030 0004 #ENTER String entered in notepad and sent to printer
      0030 0004 #KEYWORD String entered from menu scan and assigned to number of string field
      0030 0004 #REAGENT Name of default reagent
      0030 0004 #PATTERN Name of default pattern
50  0030 0004 #FILES Name of reagent data file and then pattern data file
      0030 0004 #MENU(11,4) Array of values used in displaying menu item numbers
      0030 0004 #TEMP Register for the temporary storage of real numbers
      0030 0004 END IFAGE

```

35

5 Request Jet Printer
Pattern Printing

PAGE
04-11
04:00

IBM Personal Computer BASIC Compiler V.

Offset	Byte	Source Line
0034	0046	END PATTERN STATIC
10 0047	0046	
0047	0046	DIR SCREEN(10,5),MENU(17,1),MENU(17,4)
0048	0442	
0048	0442	USUB INITIALIZE: 'read init. values and set screen
004E	0442	
004E	0442	WHILE TYPE = 0
15 0051	0444	
0051	0444	TYPE = 0
0060	0444	AS = ""
006A	0448	
006A	0448	WHILE AS = ""
0079	0448	AS = INKEY
20 0083	0448	END
0084	0448	
0084	0448	IF AS = "E" OR AS = "e" THEN TYPE = 1: 'exit end
0087	0448	IF AS = "P" OR AS = "p" THEN TYPE = 2: 'print pattern
008E	0448	IF AS = "+" THEN TYPE = 3: 'increment variable
00F4	0448	IF AS = "-" THEN TYPE = 4: 'decrement variable
25 010A	0448	IF AS = CHR(10) + CHR(17) THEN TYPE = 5: 'up arrow key
012F	0448	IF AS = CHR(10) + CHR(18) THEN TYPE = 6: 'down arrow key
0134	0448	IF AS = CHR(10) + CHR(15) THEN TYPE = 7: 'left arrow key
0179	0448	IF AS = CHR(10) + CHR(17) THEN TYPE = 8: 'right arrow key
019E	0448	IF AS > CHR(47) AND AS < CHR(58) THEN TYPE = 9: 'number 0-9
30 01B6	0448	IF AS = "S" OR AS = "s" THEN TYPE = 10: 'enter scratchpad
0202	0448	
0202	0448	OR TYPE = 10: 11, 12, 13, 14, 15, 16, 17, 18, 19, 20
021F	0448	
021F	0448	END
0223	0448	TYPE = 0
35 022A	0448	
022A	0448	EXIT SUB
022E	0448	
022E	0448	***** SUBROUTINES FOR THIS MODULE *****
022E	0448	T10: 'scratch pad
0233	0448	SCREEN 0,0,3,2:COLOR 7,0
40 0236	0448	LOCATE ROWLINE,1
0244	0448	NOTELCOP:
0249	0448	LINE INPUT NOTES
0277	044E	IF NOTES = "" THEN SCREEN 0,0,0,0:RETURN
029F	044E	LPRINT NOTES
02AC	044E	IF ROWLINE < 24 THEN ROWLINE = ROWLINE + 1
45 02C9	044E	GOTO NOTELCOP
02C3	044E	
02C3	044E	
02C3	044E	T11:
02C9	044E	RETURN: 'exit to print area, no action
02CE	044E	
50 02CE	044E	T3:
02D1	044E	'process "+" key
033C	0470	IF MENU(MENU,0) > MENU(MENU,1) THEN MENU(MENU,0) = MENU(MENU,1):RETURN: 'check max value
0372	0470	MENU(MENU,0) = MENU(MENU,0) + MENU(MENU,3): 'add increment
0380	0470	COLOR 0,7:GOSUB DISPNUM:RETURN: 'show new value
55 0388	0470	T4:
		'process "-" key

Offset	Data	Source Line
0300	0470	IF REM(NEWV,0) = REM(NEWV,1) THEN REM(NEWV,0) = REM(NEWV,1):RETURN: 'check old value
0302	0470	REM(NEWV,0) = REM(NEWV,0) - REM(NEWV,3): 'sub increment
0402	0470	COLOR 0,7:GOSUB DISPNEW:RETURN: 'show new value
0404	0470	
0406	0470	T3: 'process up arrow key
0408	0470	IF NEWV ROW 6 = 0 THEN RETURN: 'in top row already
040E	0470	NEWV = -1:GOSUB REMNEW:RETURN: 'move pointer up one
0410	0472	
0412	0472	T6: 'process down arrow key
0414	0472	IF NEWV ROW 6 = 5 THEN RETURN: 'in bottom row already
0416	0472	NEWV = 1:GOSUB REMNEW:RETURN: 'move pointer down one
0418	0472	
041A	0472	T7: 'process left arrow key
041C	0472	IF INT(NEWV / 6) = 0 THEN RETURN: 'in left column already
041E	0472	NEWV = -6:GOSUB REMNEW:RETURN: 'move pointer one left
0420	0472	
0422	0472	T8: 'process right arrow key
0424	0472	IF INT(NEWV / 6) = 2 THEN RETURN: 'in right column already
0426	0472	NEWV = 6:GOSUB REMNEW:RETURN: 'move pointer one right
0428	0472	
042A	0472	T9: 'input keys into KEYBUF until (cr) is entered
042C	0472	LOCATE 25,30:COLOR 31,3:PRINT "ENTER NEW VALUE":COLOR 15,0
042E	0472	KEYBUF = ""
0430	0476	WHILE AS < CHR\$(13)
0432	0476	LOCATE 25,47:PRINT SPACE(20):
0434	0476	LOCATE 25,47:PRINT KEYBUF:
0436	0476	AS = ""
0438	0476	WHILE AS = ""
043A	0476	AS = INKEY
043C	0476	END
043E	0476	IF AS = CHR\$(8) AND LEN(KEYBUF) > 0 THEN KEYBUF = LEFT\$(KEYBUF,LEN(KEYBUF)-1)
0440	0476	IF AS = CHR\$(13) THEN KEYBUF = KEYBUF + AS
0442	0476	END
0444	0476	TEMP = VAL(KEYBUF) 'temp has value of keys input
0446	0476	
0448	0476	'round off temp according to step size in new array
044A	0476	TEMP = INT(TEMP / (NEWV(NEWV,3) - .5)) + NEWV(NEWV,3)
044C	0476	
044E	0476	'test TEMP for excessive and minimum values in new array
0450	0476	IF TEMP > NEWV(NEWV,1) THEN TEMP = NEWV(NEWV,1)
0452	0476	IF TEMP < NEWV(NEWV,2) THEN TEMP = NEWV(NEWV,2)
0454	0476	
0456	0476	'insert new value into new array and update screen
0458	0476	NEWV(NEWV,0) = TEMP
045A	0476	LOCATE 25,30:PRINT SPACE(40):
045C	0476	COLOR 0,7:GOSUB DISPNEW
045E	0476	RETURN
0460	0476	
0462	0476	T2: 'set Burr-Brown board then print desired pattern
0464	0476	
0466	0476	RED:COLOR 15,0:LOCATE 25,1
0468	0476	PRINT "Set Potentiometers on Frontier....then Press any Key"
046A	0476	AS = ""
046C	0476	WHILE AS = ""
046E	0476	

6 Pageant Jet Printer
Pattern Printing

PAGE

09-17

08:49

IBM Personal Computer BASIC Compiler V2

Offset	Data	Source Line
0780	047A	AS = INKEY\$
10 078A	047A	HOME
078B	047A	LOCATE 25,1:PRINT SPACES(77);
07AA	047A	
07AA	047A	'enter draw parameters into temp-temp board
07AA	047A	TEMP = ADRU(0,0):CALL SET.DOT.XATE(TEMP)
0783	047A	TEMP = 0:CALL SET.DOT.WIDTH(TEMP)
15 0783	047A	TEMP = ADRU(2,0):CALL SET.STROKE.DELAY(TEMP)
0819	047A	CALL DOT.ON
0825	047A	
0825	047A	TEMP1 = 4
0825	047C	CALL DIGITAL.OUT(TEMP1)
0825	047C	TEMP1 = 0: 'pulse RESET line
20 0825	047C	CALL DIGITAL.OUT(TEMP1)
0825	047C	TEMP1 = 4
0825	047C	CALL DIGITAL.OUT(TEMP1)
0825	047C	
0825	047C	J2 = CINT(ADRU(1,0) * 255 / 150): 'set pulse amplitude by pulsing HIGHEN signal J2 number of times
25 0825	047C	FOR J2 = 1 TO J2
0827	0480	TEMP1 = 6: 'set HIGHEN true
0827	0480	CALL DIGITAL.OUT(TEMP1)
0827	0480	TEMP1 = 4: 'set HIGHEN false
0827	0480	CALL DIGITAL.OUT(TEMP1)
0827	0480	NEXT J2
30 0827	0482	
0827	0482	'establish COM1 and initialize plotter
0827	0482	OPEN "COM1:2400,N,8,1,CS,ASCII" AS #1
0827	0482	PRINT #1,":HEX,5771,n")
0902	0482	
0902	0482	'save nozzle offset and establish new origin
35 0902	0482	PRINT #1,"AO";
0912	0482	
0912	0482	'calculate row/column location, save there, and set new origin
0912	0482	J2 = (ADRU(12,0)-1) * (ADRU(14,0) / 0.005)
0912	0482	J3 = (ADRU(13,0)-1) * (ADRU(15,0) / 0.005)
0912	0482	PRINT #1,J2;J3;"O";
40 0912	0486	
0912	0486	'print the pattern using repeat count
0912	0486	REPT1 = ADRU(8,0) / 0.005
0912	0486	REPT2 = ADRU(9,0) / 0.005
0912	0486	
0912	0486	FOR REPEAT1 = 0 TO ADRU(17,0)
45 0912	048C	
0912	048C	'print the pattern
0912	048C	FOR C72 = 0 TO CLANG2 - 1
0912	048C	ON SCARDATE(C72,0) GOSUB PLINE, PTEXT, PTEXT, PCIRCL
0912	048C	NEXT C72
50 0912	0492	
0912	0492	PRINT #1,"O,O,O,"; 'return to origin
0912	0492	PRINT #1,REPT1;REPT2;"O"; 'save to next pattern
0912	0492	NEXT REPEAT1
0912	0494	
0912	0494	PRINT #1,"N"; 'return plotter to original HOME
0912	0494	

5 Request Jet Printer
Pattern Printing

PAGE
04-17
08:49

IBM Personal Computer BASIC Compiler V2

Offset	Data	Source Line
0431	0494	CLONE 111 "Disable cache"
0438	0494	
0439	0494	RETURN
043C	0494	
043E	0494	PLINE:
04C1	0494	PRINT 01,SCDATA(CTL,2);SCDATA(CTL,1);"0";
04C3	0494	PRINT 01,SCDATA(CTL,4);SCDATA(CTL,3);"0";
04C5	0494	RETURN
04C9	0494	
04C9	0494	PERECT:
04CE	0494	PRINT 01,SCDATA(CTL,2);SCDATA(CTL,1);"0";
04D0	0494	PRINT 01,SCDATA(CTL,4);SCDATA(CTL,3);
04D2	0494	PRINT 01,SCDATA(CTL,2);SCDATA(CTL,3);
04D8	0494	PRINT 01,SCDATA(CTL,2);SCDATA(CTL,1);"0";
04DA	0494	PRINT 01,SCDATA(CTL,2);SCDATA(CTL,1);"0";
04DB	0494	RETURN
04DB	0494	
04DB	0494	PERECT:
04D9	0494	RADIUS = SQR((SCDATA(CTL,3)-SCDATA(CTL,1)) ² + (SCDATA(CTL,4)-SCDATA(CTL,2)) ²)
04E1	0494	PRINT 01,"00 ";SCDATA(CTL,2);SCDATA(CTL,1);RADIUS;
04E3	0494	RETURN
04E7	0494	
04E7	0494	PERECT:
04EC	0494	SIZ = SCDATA(CTL,1);EIZ = SCDATA(CTL,2)
04ED	0494	SYZ = SCDATA(CTL,3);EYZ = SCDATA(CTL,4)
04EE	0494	IF EIZ <= SIZ THEN SIZ = SCDATA(CTL,2);EIZ = SCDATA(CTL,1)
04EF	0494	IF EYZ <= SYZ THEN SYZ = SCDATA(CTL,3);EYZ = SCDATA(CTL,4)
04F0	0494	
04F1	0494	PRINT 01,SIZ;SYZ;"0";
04F4	0494	
04F4	0494	IF EIZ - SIZ >= EYZ - SYZ THEN GOSUB STEP1 ELSE GOSUB STEP1
04F7	0494	
04F8	0494	PRINT 01,"0";
04FA	0494	RETURN
04FB	0494	
04FB	0494	STEP1:
04F8	0494	PRINT 01,EIZ;SYZ;
04F9	0494	SYZ = SYZ + 1
04FA	0494	IF SYZ > EYZ THEN RETURN
04FB	0494	PRINT 01,EIZ;SYZ;SIZ;SYZ;
04FC	0494	SYZ = SYZ + 1
04FD	0494	IF SYZ > EYZ THEN RETURN
04FE	0494	PRINT 01,SIZ;SYZ;
04FF	0494	GOTO STEP1
04FF	0494	
04FF	0494	STEP2:
04FF	0494	PRINT 01,SIZ;EYZ;
04FF	0494	SIZ = SIZ + 1
04FF	0494	IF SIZ > EIZ THEN RETURN
04FF	0494	PRINT 01,SIZ;EYZ;SIZ;SYZ;
04FF	0494	SIZ = SIZ + 1
04FF	0494	IF SIZ > EIZ THEN RETURN
04FF	0494	PRINT 01,SIZ;SYZ;
04FF	0494	GOTO STEP1

6 Reagent Jet Printer
Pattern Printing

PAGE

09-17

08:49

IBM Personal Computer BASIC Compiler V2

Offset	Data	Source Line
0F07	04FE	
10 0F07	04FE	KEYSCREEN: 'write old itoa in yellow, point to and highlight new itoa
0F0C	04FE	COLOR 14,0:GOSUB DISPMENU
0F0E	04FE	MENU = MENU + DIFF
0F0A	04FE	IF MENU = 10 THEN MENU = 9
100C	04FE	IF MENU = 11 THEN MENU = 9
101E	04FE	IF MENU > 15 THEN MENU = 15
1030	04FE	COLOR 0,7:GOSUB DISPMENU:RETURN
1046	04FE	
1046	04FE	INITIALIZE:
1048	04FE	'change to screen 0 and display messages
104B	04FE	SCREEN 0,0,1,1:COLOR 7,0:CLS:LOCATE 10,17:PRINT "Loading selected Reagent and Pattern Data Files";
108F	04FE	LOCATE 12,31:PRINT "Please Wait..."
20 10A9	04FE	
10A9	04FE	'initialize notepad on screen 2
10A9	04FE	SCREEN 0,0,2,1:CLS:COLOR 15
10CE	04FE	PRINT "Digital Notepad - - All information typed here is sent to the printer"
10D9	04FE	NOTELINES = 3
25 10E2	04FE	
10E2	04FE	'initialize menu arrays
10E2	04FE	RESTORE ARCDATA
10E9	04FE	FOR I=0 TO 17
10EF	04FE	READ MENU(I),MENU(I),MENU(I),MENU(I),MENU(I),MENU(I),MENU(I),MENU(I),MENU(I),MENU(I),MENU(I),MENU(I),MENU(I),MENU(I),MENU(I),MENU(I),MENU(I),MENU(I)
111F	04FE	READ MENU(I),MENU(I),MENU(I),MENU(I),MENU(I),MENU(I),MENU(I),MENU(I),MENU(I),MENU(I),MENU(I),MENU(I),MENU(I),MENU(I),MENU(I),MENU(I),MENU(I),MENU(I)
30 1180	04FE	NEXT I
1193	04FE	
1193	04FE	'get default reagent file and read values
1193	04FE	
1193	04FE	OPEN "REAGET.RJP" FOR INPUT AS #1
11A4	04FE	INPUT #1,FILE1
35 11B6	04A2	INPUT #1,REAGENT
11C8	04A6	CLOSE #1
11CF	04A6	
11CF	04A6	OPEN FILE1 FOR INPUT AS #1: 'get reagent data
11E0	04A6	INPUT #1,RENU(0,0): 'frequency
1200	04A6	INPUT #1,RENU(1,0): 'amplitude
40 1223	04A6	INPUT #1,RENU(2,0): 'stroke delay
1246	04A6	INPUT #1,RENU(3,0): 'pulse width
1269	04A6	INPUT #1,RENU(4,0): 'rise time
128C	04A6	INPUT #1,RENU(5,0): 'fall time
1291	04A6	CLOSE #1
1298	04A6	
45 1298	04A6	'get default pattern file and read values
1298	04A6	
1298	04A6	OPEN "PATDEF.RJP" FOR INPUT AS #1
12C9	04A6	INPUT #1,FILE2
12D0	04A6	INPUT #1,PATTERN
12ED	04A6	CLOSE #1
50 12F4	04A6	
12F4	04A6	OPEN FILE2 FOR INPUT AS #1: 'get pattern data
12C5	04A6	INPUT #1,RENU(6,0): 'grid
1317	04A6	INPUT #1,RENU(7,0): 'repeat count
132A	04A6	INPUT #1,RENU(8,0): 'offset
133D	04A6	

6 Bagmont Jet Printer
Pathways Printing

PAGE
04-17
04:49

IBM Personal Computer BASIC Compiler V2

Offset	Hex	Source Line
1330	04AA	INPUT #1,ADDR(19,01) 'y offset
1333	04AA	FOR J2 = 0 TO CLAMP-1
1331	04AC	FOR J1 = 0 TO 5
1337	04AC	INPUT #1,STARTX(112,J1)
1339	04AC	NEXT J1
133B	04AC	NEXT J2
133D	04AC	CLOSE #1
1404	04AC	'set processing parameters in some array
1406	04AC	
1404	04AC	MEM(112,01) = 1: 'row 1
1420	04AC	MEM(113,01) = 1: 'column 1
143C	04AC	MEM(114,01) = 0: 'row spacing
1450	04AC	MEM(115,01) = 0: 'column spacing
1474	04AC	
1474	04AC	'change active displayed screen to screen 0 to draw and display parameters
1474	04AC	
1474	04AC	SCREEN 0,0,0,1:CLS
1491	04AC	
1491	04AC	COLOR 15:LOCATE 1,32:PRINT "REAGENT PRINTING";
1492	04AC	COLOR 9
1499	04AC	FOR I=2 TO 79
14C3	04AC	LOCATE 3,1:PRINT CHR\$(176);LOCATE 5,1:PRINT CHR\$(223);LOCATE 10,1:PRINT CHR\$(176);
1523	04B0	NEXT I
153E	04B0	FOR I=4 TO 17
1548	04B0	LOCATE 1,1:PRINT CHR\$(177);LOCATE 1,20:PRINT CHR\$(184);LOCATE 1,34:PRINT CHR\$(184);LOCATE 1,5
		PRINT CHR\$(179);
15C8	04B0	NEXT I
15E6	04B0	RESTORE TABLE
15E9	04B0	FOR I=1 TO 12
15F7	04B0	READ #1,C1,C2:LOCATE #1,C1:PRINT CHR\$(C2);
162A	04B6	NEXT I
1645	04B6	
1645	04B6	'display 16 row choices in yellow
1645	04B6	
1645	04B6	COLOR 14,0
1651	04B6	FOR REM=0 TO 15
1657	04B6	GOSUB DISPMENU
1659	04B6	NEXT REM
1660	04B6	
1660	04B6	'set for first row entry and highlight it
1660	04B6	MEM(1) = 0:COLOR 0,7
1660	04B6	GOSUB DISPMENU
1686	04B6	
1686	04B6	'print three headings and instructions
1686	04B6	COLOR 10,0
1692	04B6	LOCATE 4,14.5-LEN(REFNAME)/2:PRINT REFNAME;
16C1	04B6	LOCATE 4,41-LEN(PATHNAME)/2:PRINT PATHNAME;
16F0	04B6	LOCATE 4,34:PRINT "PRINT LOCATION";
170A	04B6	
170A	04B6	COLOR 7:LOCATE 19,20:PRINT "Use ";COLOR 15:PRINT CHR\$(27);CHR\$(32);CHR\$(26);
1734	04B6	PRINT CHR\$(32);CHR\$(24);CHR\$(32);CHR\$(23);COLOR 7:PRINT " to position highlighted cursor";
1793	04B6	LOCATE 20,18:PRINT "Use ";COLOR 15:PRINT "-";COLOR 7:PRINT " or ";COLOR 15:PRINT "+";
17E7	04B6	COLOR 7:PRINT " to scroll current value up or down";

8

10

15

20

Request Jet Printer
Pattern Printing

PAGE
09-17-
00:49:

IBM Personal Computer BASIC Cassette V2.

Offset Data Source Line

```

25 1770 0486 LOCATE 21,3:PRINT "Use ";COLOR 15:PRINT "7";COLOR 7:PRINT " to print pattern or ";
    182F 0486 COLOR 15:PRINT "E";COLOR 7:PRINT " to exit to print menu";
    1867 0486 PRINT " or ";COLOR 15:PRINT "S";COLOR 7:PRINT " to use notepad";
    189C 0486
    189C 0486 "set screen to view menu just created and exit
    189C 0486
30 189C 0486 SCREEN 0,0,0,0
    18B1 0486 RETURN
    18B5 0486
    18B5 0486 DISP MENU;
    18BA 0486 IF MENU = 10 OR MENU = 11 THEN RETURN
    182C 0486 LOCATE (MENU MOD 61+2*7,(INT(MENU/61)+28+2)-2*(INT(MENU/12)
35 1730 0486 PRINT MENU(MENU,0)
    1756 0486 LOCATE (MENU MOD 61+2*7,MENU(MENU,0)
    17E9 0486 PRINT USING MENU(MENU,1);MENU(MENU,0);
    1730 0486 RETURN
    172F 0486 END IF PAGE

```

40

45

50

55

Request Jet Printer
Pattern Printing

10

Offset Data Source Line

PAGE

01-17

08:41

IBM Personal Computer BASIC Compiler V2

```

1977 0426 ***** DATA USED BY THIS MODULE *****
1977 0426
75 197F 0426 ARGUMENTS:
1978 0426 DATA "Dot Frequency"      80,"10,100",10000,1,1,16
1979 0426 DATA "Amplitude"          9,"100",150,0,1,19
1980 0426 DATA "Strobe Delay"      65,"10,100,1",15779,5,2,16
1981 0426 DATA "Pulse Width"       1,"100",999,0,1,19
1982 0426 DATA "Rise Time"        1,"100",999,0,1,19
20 1983 0426 DATA "Fall Time"      1,"100",999,0,1,19
1984 0426 DATA "Grid Size"        16,"0.100",.005,.005,45
1985 0426 DATA "Repeat Count"     1,"10",99,0,1,47
1986 0426 DATA "X Axis Offset"    16,"0.100",2,0,.005,45
1987 0426 DATA "Y Axis Offset"    16,"0.100",2,0,.005,45
25 1988 0426 DATA "",0,0,0,0
1989 0426 DATA "",0,0,0,0
1990 0426 DATA "How to Print"      1,"10",99,1,1,74
1991 0426 DATA "Column to Print" 1,"10",99,1,1,74
1992 0426 DATA "Row Spacing"     16,"0.100",3,0,.005,72
20 1993 0426 DATA "Column Spacing" 16,"0.100",3,0,.005,72
1994 0426 DATA "",0,0,0,0
30 1995 0426 DATA "",0,0,0,0
1996 0426
1997 0426 TABLE:
1998 0426 DATA 3,1,218
1999 0426 DATA 3,20,210
35 199A 0426 DATA 3,51,210
199B 0426 DATA 3,80,191
199C 0426 DATA 5,1,198
199D 0426 DATA 5,20,204
199E 0426 DATA 5,51,204
199F 0426 DATA 5,80,181
40 1999 0426 DATA 10,1,192
199A 0426 DATA 10,20,208
199B 0426 DATA 10,51,208
199C 0426 DATA 10,80,217
199D 0426
45 199E 0426 END SUB
199F 0426
2000 0426

```

50426 Bytes Available

44716 Bytes Free

50

0 Warning Error(s)
0 Severe Error(s)

55

Reagent: Jet Printer
Reagent Filing

PAGE 1
07-09-86
13:04:33

Offset: Date Source Line IBM Personal Computer BASIC Compiler V2.00

```

0030 0006 *** TITLE: 'Reagent Jet Printer' $SUBTITLE: 'Reagent Filing'
0030 0006 *MODULE - 'REAGENT' File Handling for reagents
0030 0006
0030 0006 *AUTHOR - L. A. Enevold
0030 0006
10 0030 0006 *COPYRIGHT (C) 1985 ABBOTT LABORATORIES
0030 0006
0030 0006 *REVISION - 1.1 03-07-86 MAE Added notes and description
0030 0006 *          1.0 02-14-86 MAE Creation of initial code
0030 0006
15 0030 0006 *SYSTEM - This code can only be compiled by the BASCOM
0030 0006 *          COMPILER, it will not run under the INTERPRETER!!
0030 0006
0030 0006 *DESCRIPTION:
20 0030 0006 *          This module allow file handling for reagents. When inv
0030 0006 *          oted, it displays
0030 0006 *          the current contents of the reagent directory in 4 colu
0030 0006 *          ans of 20 entries
0030 0006 *          each. The reagent which is currently selected for prin
25 0030 0006 *          ting is marked by
0030 0006 *          an asterisk to the left of the reagent name. After the
0030 0006 *          directory is listed
0030 0006 *          the user is presented with 5 menu choices. The left an
0030 0006 *          d right arrows are
30 0030 0006 *          used to highlight menu items and the enter key is used
0030 0006 *          to invoke action.
0030 0006 *          The menu choices and their actions are:
0030 0006
0030 0006 *          DELETE - Remove a reagent file from the directo
35 0030 0006 *          ry
0030 0006 *          COPY - Copy a reagent file to a new reagent n
0030 0006 *          ame, saving the old reagent
0030 0006 *          RENAME - Change the name of the reagent without
0030 0006 *          changing the reagent itself
40 0030 0006 *          SELECT - Select a reagent for printing
0030 0006 *          EXIT - Return to the main menu
0030 0006
0030 0006 *DATA DICTIONARY
0030 0006 *          TYPE1 Which type of valid key was pushed
45 0030 0006 *          MENU1 Which menu item is being pointer to (0-4)
0030 0006 *          DIFF1 Distance to move MENU1 at left or right arro
0030 0006
0030 0006 *          FLAG1 Error type 0-4
0030 0006 *          POINTER1 Position of RENAME1 in directory list
50 0030 0006 *          REAMENU1 Number of reagent names in directory
0030 0006 *          list
0030 0006 *          TEMP1 Storage for integers during reagent copy
0030 0006 *          AS Misc. input string
0030 0006 *          FUNCT1 Printed at bottom of screen during prompt fo
65 0030 0006 *          r reagent name
0030 0006 *          RENAMES1 Reagent name currently being worked on
0030 0006 *          SELNAMES1 Reagent name currently selected for printing
0030 0006 *          FILES1 Filename of reagent data file
0030 0006 *          SFILES1 Filename for source reagent data file used d

```

Reagent Jet Printer
Reagent Filing

PAGE 2
97-09-86
15:04:35

IBM Personal Computer BASIC Compiler V2.00

Offset	Data	Source Line
0030	0006	uring copy
0030	0006	FILES Filenase for destination reagent data file n
0030	0006	ses during copy
0030	0006	NEWNAME New reagent name for COPY and RENAME
0030	0006	TERPS Reagent names are held here as the directory
0030	0006	is being re-written
0030	0006	NEWFILE Destination filenase used while copying reag
0030	0006	ent data files
0030	0006	MESSAGE A message printed at the botton of the scree
0030	0006	Array of strings containing the short and lo
0030	0006	eq rena names
0030	0006	ERRMSG Message printed when any error occurs
0030	0006	ERRS Appended to ERRMSG to indicate nature of er
0030	0006	ror
0030	0006	REN SPAGE

Reagent Jet Printer
Reagent Filing

PAGE 3
07-09-86
15:04:35

IBM Personal Computer BASIC Compiler V2.00

Offset	Data	Source Line
0030	0003	END REAGENT.FILE STATIC
0047	0006	GOSUB INITIALIZE
0048	0006	TYPE1 = 0
0054	0008	WHILE TYPE1 < 3
0054	0008	AS = ""
0057	0008	WHILE AS = ""
0069	000C	AS = INKEYS
0078	000C	AS = INKEYS
0082	000C	IF AS = CHR\$(10) + CHR\$(75) THEN TYPE1 = 1:
0083	000C	IF AS = CHR\$(10) + CHR\$(77) THEN TYPE1 = 2:
00AA	000C	IF AS = CHR\$(13) THEN TYPE1 = 3:
00CF	000C	IF AS = CHR\$(13) THEN TYPE1 = 3:
00E7	000C	ON TYPE1 GOSUB T1, T2, T3
00E7	000C	ON TYPE1 GOSUB T1, T2, T3
00F8	000C	WEND
00FC	000C	EXIT SUB
00FC	000C	EXIT SUB
0100	000C	REN SPAGE
0100	000C	REN SPAGE

Reagent Jet Printer
Reagent Filling

PAGE 4
07-09-86
15:04:35

Offset Data Source Line IBM Personal Computer BASIC Compiler V2.00

```

0100 000C '***** SUB-ROUTINES FOR THIS MODULE *****
0100 000C
0100 000C T1: 'left arrow
0103 000C TYPE1 = 0
010C 000C IF KEYZ = 0 THEN RETURN
0110 000E DIFF1 = -1
0122 0010 GOSUB XEN.MENU
0128 0010 RETURN
012C 0010
012C 0010 T2: 'right arrow
0131 0010 TYPE2 = 0
0137 0010 IF KEYZ = 4 THEN RETURN
0147 0010 DIFF2 = 1
014E 0010 GOSUB XEN.MENU
0154 0010 RETURN
0158 0010
0158 0010 T3: '(cr) (execute selected menu item)
015D 0010 LOCATE 25,1:PRINT SPACES(79);
017A 0010 ON KEYZ + 1 GOSUB T2A, T3B, T3C, T3D, T3E
018F 0010 GOSUB MENU.ON
0195 0010 RETURN
0199 0010
0199 0010 REX 4PAGE

```

Reagent Jet Printer
Reagent Filling

DATE 5
07-09-86
15:04:35
ISA Personal Computer BASIC Compiler V2.00

```

6      Offset Data Source Line
      0199 0010 TJA: 'delete reagent
      019E 0010 TYPE1 = 0
      01A5 0010 FUNCT1 = "delete"
      01AF 0014 GOSUB 667.SOURCE
10     01B5 0014 IF LEN(REANAME1) = 0 THEN RETURN
      01C7 0018 IF REANAME1 = SELNAME1 THEN FLAG1 = 4:GOSUB SHOW.ERROR:
      RETURN
      01E7 001E GOSUB SEARCH
      01ED 001E IF POINTER1 = 0 THEN FLAG1 = 1:GOSUB SHOW.ERROR:RETURN
15     0209 0020
      0209 0020 MESSAGES = "Deleting " + REANAME1 + " Please Wait..
      0220 0024
      0226 0024 GOSUB MESSAGE.ON
      0226 0024
20     0226 0024 'rewrite directory deleting REANAME1 as indicat
      ed by POINTER1
      0226 0024 KILL "READIR.OLD"
      022D 0024 NAME "READIR.RJP" AS "READIR.OLD"
      0237 0024 OPEN "READIR.OLD" FOR INPUT AS #1
25     0248 0024 OPEN "READIR.RJP" FOR OUTPUT AS #2
      025A 0024
      025A 0024 INPUT #1, REANUM1
      026C 0026 REANUM1 = REANUM1 - 1
      0275 0026 WRITE #2, REANUM1
30     0284 0026
      0284 0026 IF REANUM1 = 0 THEN GOTO DIR.DONE
      0292 0026 FOR I1 = 1 TO REANUM1 + 1
      02A4 0028 INPUT #1, REANAME1
      02B6 0028 IF I1 < POINTER1 THEN PRINT #2, REANAME1
35     02D3 002A NEXT I1
      02E3 002A
      02E3 002A DIR.DONE:
      02EA 002A CLOSE #1:CLOSE #2
      02F8 002A
40     02F8 002A 'remove data file
      02F8 002A FILES = RIGHT$(STR$(POINTER1), LEN(STR$(POINTER1))-1) +
      "REA.RJP"
      031C 002E KILL FILES
      0323 002E
45     0323 002E 'rename remaining data files to maintain linked
      list to directory
      0323 002E WHILE (REANUM1 + 1) > POINTER1
      0333 002E SFILES = RIGHT$(STR$(POINTER1+1), LEN(STR$(POINT
      ER1+1))-1) + "REA.RJP"
50     0339 0032 DFILES = RIGHT$(STR$(POINTER1), LEN(STR$(POINTER
      1))-1) + "REA.RJP"
      037D 0036 NAME SFILES AS DFILES
      0387 0036 POINTER1 = POINTER1 + 1
      0390 0036 WEND
55     0393 0036
      0393 0036 GOSUB MESSAGE.OFF
      0399 0036 REANAME1 = SELNAME1
      03A3 0036 GOSUB TJD1
      03A9 0036 GOSUB DISP.DIR

```

6

10

16

20

25

Resgent Jet Printer
Resgent Filing

PAGE 6
07-09-86
15:04:33

Offset Data Source Line

IBM Personal Computer BASIC Compiler V2.00

30

032F 0036 RETURN
0383 0036
0383 0036 REM SPACE

35

40

45

50

55

Reagent Jet Printer
Reagent Filing

*PST 7
07-09-86
15:04:33
IBM Personal Computer BASIC Compiler V2.00

Offset	Data	Source Line
6	0383 0036	133: 'copy reagent
	0388 0036	TYPEZ = 0
	038F 0036	IF REAMUMZ = 80 THEN FLAGZ = 3:GOSUB SHOW.ERROR:RETURN
10	0398 0036	FUNCTZ = 'Copy'
	03E5 0036	GOSUB GET.SOURCE
	03EB 0036	IF LEN(REAMUMZ) = 0 THEN RETURN
	03FD 0036	GOSUB SEARCH
	0403 0036	IF POINTERZ = 0 THEN FLAGZ = 1:GOSUB SHOW.ERROR:RETURN
15	041F 0036	GOSUB GET.NEW.NAME
	0425 0036	IF LEN(NEWNAMEZ) = 0 THEN RETURN
	0437 003A	IF LEN(NEWNAMEZ) > 15 THEN FLAGZ = 2:GOSUB SHOW.ERROR:RETURN
		ETURN
20	0457 003A	MESSAGEZ = 'Copying ' + REAMUMZ + ' to ' + NEWNAMEZ +
	0457 003A	' Please wait...'
	047C 003A	GOSUB MESSAGE.ON
	0482 003A	
25	0482 003A	'add new name at end of directory
	0482 003A	KILL 'READIR.OLD'
	0489 003A	NAME 'READIR.RJP' AS 'READIR.OLD'
	0493 003A	OPEN 'READIR.OLD' FOR INPUT AS #1
	04A4 003A	OPEN 'READIR.RJP' FOR OUTPUT AS #2
30	04B6 003A	
	04B6 003A	INPUT #1, REAMUMZ
	04C8 003A	REAMUMZ = REAMUMZ + 1
	04D1 003A	WRITE #2, REAMUMZ
	04E2 003A	
35	04E2 003A	FOR IZ = 1 TO REAMUMZ - 1
	04F1 003C	INPUT #1, TEMPZ
	0503 0040	PRINT #2, TEMPZ
	0513 0040	NEXT IZ
	0525 0040	PRINT #2, NEWNAMEZ
40	0533 0040	
	0533 0040	CLOSE #1:CLOSE #2
	0543 0040	
	0543 0040	'create copy of data file
	0543 0040	FILES = RIGHTS(STR\$(POINTERZ), LEN(STR\$(POINTERZ)) - 1) +
45	0567 0040	'REA.RJP'
	0567 0040	NEWFILES = RIGHTS(STR\$(REAMUMZ), LEN(STR\$(REAMUMZ)) - 1) +
	0567 0040	'REA.RJP'
	058B 0044	
	058B 0044	OPEN FILES FOR INPUT AS #1
50	059C 0044	OPEN NEWFILES FOR OUTPUT AS #2
	05AE 0044	
	05AE 0044	INPUT #1, TEMP
	05C0 0048	WRITE #2, TEMP: 'frequency
	05D0 0048	INPUT #1, TEMP
	05E2 0048	WRITE #2, TEMP: 'pulse width
55	05F2 0048	INPUT #1, TEMP
	0604 0048	WRITE #2, TEMP: 'strobe delay
	0614 0048	INPUT #1, TEMP
	0626 0048	WRITE #2, TEMP: 'nozzle
	0636 0048	

Reagent Jet Printer
Reagent Filling

PAGE 8

07-09-86

13:04:33

Offset Data Source Line IBM Personal Computer BASIC Compiler V2.00

0636	0048	INPUT #1,TEMP#	
0640	0048	PRINT #2,TEMP#:	'concentration
0650	0048	INPUT #1,TEMP#	
066A	0048	PRINT #2,TEMP#:	'density
067A	0048	INPUT #1,TEMP#	
068C	0048	PRINT #2,TEMP#:	'viscosity
069C	0048		
069C	0048	CLOSE #1:CLOSE #2	
06AA	0048		
06AA	0048	GOSUB MESSAGE.GFF	
06B0	0048	GOSUB DISP.DIR	
06B6	0048	RETURN	
06BA	0048		
06BA	0048	REN #PAGE	

Reagent Jet Printer
Reagent Filing

PAGE 9
07-09-86
15:04:33

	Offset	Data	Source Line	IBM Personal Computer BASIC Compiler V2.00
	06BA	0048	TCC:	'rename reagent
	06BF	0048		TYPEZ = 0
15	06C6	0048		FUNCTS = 'Rename'
	06C0	0048		GOSUB GET.SOURCE
	06D6	0048		IF LEN(REANAMES) = 0 THEN RETURN
	06E8	0048		GOSUB SEARCH
	06EE	0048		IF POINTERZ = 0 THEN FLAGZ = 1:GOSUB SHOW.ERROR:RETURN
20	070A	0048		GOSUB GET.NEW.NAME
	0710	0048		IF LEN(NEWNAME) = 0 THEN RETURN
	0722	0048		IF LEN(NEWNAME) > 15 THEN FLAGZ = 2:GOSUB SHOW.ERROR:R
			ETURN	
25	0742	0048		IF NEWNAME = REANAMES THEN RETURN
	0753	0048		MESSAGES = 'Renaming ' + REANAMES + ' to ' + NEWNAME +
			' Please wait..'	
	077A	0048		GOSUB MESSAGE.ON
	0780	0048		
30	0790	0048		'renaming reagent name in directory
	0780	0048		KILL 'READIR.OLD'
	0787	0048		NAME 'READIR.RJP' AS 'READIR.OLD'
	0791	0048		OPEN 'READIR.OLD' FOR INPUT AS #1
	07A2	0048		OPEN 'READIR.RJP' FOR OUTPUT AS #2
35	07B4	0048		
	07B4	0048		INPUT #1, REAMURZ
	07C6	0048		WRITE #2, REAMURZ
	07D7	0048		
	07D7	0048		FOR IZ = 1 TO REAMUPZ
40	07E4	004A		INPUT #1, TEMPZ
	07F6	004A		IF IZ (<) POINTERZ THEN PRINT #2, TEMPZ
	0813	004A		IF IZ = POINTERZ THEN PRINT #2, NEWNAME
	0830	004A		NEXT IZ
	0842	004A		
45	0842	004A		CLOSE #1:CLOSE #2
	0850	004A		
	0850	004A		GOSUB MESSAGE.OFF
	0856	004A		IF REANAMES = SELNAME THEN REANAMES = NEWNAME:GOSUB T
			JDA	
50	0875	004A		GOSUB DISP.DIR
	087B	004A		RETURN
	087F	004A		
	087F	004A		REN SPAGE

Reagent Jet Printer
Reagent Filing

PAGE 10
07-09-85
15:04:35

Offset: Data Source Line IEN Personal Computer BASIC Console V2.00

```

15      0677 0042 TJS: 'select reagent for printing
      0681 0040      'YFEL = 0
      0883 0040      FUNCT3 = 'Select'
      0895 0040      GOSUB GET.SOURCE
20      0893 0040      IF LEN(REALNAME) = 0 THEN RETURN
      0886 0040      IF REALNAME = SELNAME THEN RETURN
      06C9 0042      GOSUB TISA
      08C6 0040      GOSUB DISP.BIR
      08CC 0040      RETURN
25      08D0 0040 TJS:
      08D0 0040      BEGIN SEARCH
      08D3 0040      IF POINTER2 = 0 THEN FLAG2 = 1:GOSUB SHOW.ERROR:RETURN
      08F7 0040
30      08F7 0040      MESSAGE$ = 'Selecting ' + REALNAME + '      Please Wait.
      ..
      090E 0040      GOSUB MESSAGE.ON
      0914 0040
      0914 0040      'change entrys in reagent default file READEF.R
35      JP
      0914 0040      OPEN 'READEF.RJP' FOR OUTPUT AS #1
      0926 0040      FILES = RIGHTS(STR$(POINTER2),LEN(STR$(POINTER2))-1) +
      'REA.RJP'
40      094A 0040      PRINT #1,FILES
      094A 0040      PRINT #1,REALNAME
      0962 0040
      096A 0040      CLOSE #1
      0971 0040      GOSUB MESSAGE.OFF
45      0977 0040      RETURN
      0973 0040
      0973 0040 TJS: 'exit reagent filing
      0980 0040      RETURN
      0984 0040
50      0984 0040      SET YFAGE

```



```

6      Offset  Data  Source Line
      0984  004A  SEAPEN:
      0989  004A  POINTERS = 0
      0990  004A  OPEN "READIR.RJP" FOR INPUT AS #1
      09A1  004A  INPUT #1,REANUM1:  'get number of reagents in direc
10
      09B3  004A  IF REANUM1 = 0 THEN CLOSE #1:RETURN
      09C9  004A  TEMP1 = ""
      09D3  004A  WHILE (POINTERS < REANUM1) AND (REANAMES <> TEMP1)
      09F5  004A  LINE INPUT #1,TEMP1
      0A06  004A  POINTERS = POINTERS + 1
15
      0A11  004A  WEND
      0A14  004A  IF REANAMES <> TEMP1 THEN POINTERS = 0
      0A2A  004A  CLOSE #1
      0A31  004A  RETURN
20
      0A33  004A
      0A33  004A  GET.SOURCE:
      0A3A  004A  LOCATE 25,1:COLOR 15,0:PRINT "Enter Reagent Name to 'FU
      NCTs" *;
      0A6C  004A  LINE INPUT;"",REANAMES
      0A7A  004A  LOCATE 25,1:PRINT SPACES(79);
      0A97  004A  RETURN
      0A98  004A
      0A98  004A  GET.NEW.NAME:
      0AA0  004A  LOCATE 25,1:COLOR 15,3:PRINT "Enter New Reagent Name ";
      0AC6  004A  LINE INPUT;"",NEWNAME
      0AD4  004A  LOCATE 25,1:PRINT SPACES(79);
      0AF1  004A  RETURN
      0AF3  004A
      0AF3  004A  DISP.DIR:  'display reagent directory in 4 columns of 20 r
      cas
      0AFA  004A  'read selected reagent into SELNAME
      0AFA  004A  OPEN "REDEF.RJP" FOR INPUT AS #1
      0B03  004A  INPUT #1,SELNAME:  'read and discard data file nam
40
      0B19  004A  INPUT #1,SELNAME:  'read and save reagent name
      0B2F  004A  CLOSE #1
      0B36  004A
      0B36  004A  OPEN "READIR.RJP" FOR INPUT AS #1
      0B47  004A  INPUT #1,REANUM1:  'read number of reagents
45
      0B59  004A  MESSAGE$ = "Reading Reagent Directory Please Wait"
      0B63  004A  GOSUB MESSAGE.ON
      0B69  004A  FLAG1 = 0
      0B70  004A  TEMP1 = REANUM1 - 1:IF REANUM1 < 80 THEN TEMP1 = REANUM
50
      0B88  004C  1
      0B97  004E  FOR I2 = 0 TO TEMP1
      0BCA  004E  LOCATE (I2 MOD 20)+1,(INT(I2/20)+20)+1
      0BDA  004E  PRINT SPACES(18);
      0BEC  004E  NEXT I2
55
      0BEC  004E  FOR I2 = 0 TO REANUM1 - 1
      0BFA  0050  INPUT #1,REANAMES
      0C0C  0050  LOCATE (I2 MOD 20)+1,(INT(I2/20)+20)+3
      0C3F  0050  PRINT REANAMES;
      0C4C  0050  IF REANAMES = SELNAME THEN LOCATE (I2 MOD 20)+

```

Offset Data Source Line (Z) Personal Computer BASIC Compiler V2.00

```

5
      1, (INT(12/20)+20)+1:PRINT " ";
      NEXT I2
      CLOSE #1
      STATUS MESSAGE OFF
10     RETURN
      0001 0050 INITIALIZE:
      0002 0050 DIR MENU$(4,1)
      0003 0078 MENU$(0,0) = "Delete"
      0004 0078 MENU$(0,1) = "Remove a reagent file from the directory"
15     0005 0078 MENU$(1,0) = "Copy"
      0006 0078 MENU$(1,1) = "Copy a reagent file to a new reagent base

      0007 0078 MENU$(2,0) = "Rename"
      0008 0078 MENU$(2,1) = "Rename a reagent file in the directory"
20     0009 0078 MENU$(3,0) = "Select"
      0010 0078 MENU$(3,1) = "Select a reagent file to be printed"
      0011 0078 MENU$(4,0) = "Exit"
      0012 0078 MENU$(4,1) = "Return to the main menu"

25     0013 0078 COLOR 9,0:CLS
      0014 0078 LOCATE 21,1
      0015 0078 FOR I2 = 1 TO 80
      0016 0078 PRINT " ";
30     0017 0078 NEXT I2

      0018 0078 FOR MENUZ = 0 TO 4
      0019 0078 GOSUB MENU.GFF
      0020 0078 NEXT MENUZ

35     0021 0078 GOSUB DISP.DIR
      0022 0078 IF FLAG2 > 0 THEN GOSUB SHOW.ERROR
      0023 0078 MENUZ = 4
      0024 0078 GOSUB MENU.ON

40     0025 0078 RETURN
      0026 0078
      0027 0078 REM MENU:
      0028 0078 GOSUB MENU.OFF
45     0029 0078 MENUZ = MENUZ + 01FF2
      0030 0078 GOSUB MENU.ON
      0031 0078 RETURN

      0032 0078 MENU.ON:
      0033 0078 LOCATE 22, (MENUZ+10)+10
60     0034 0078 COLOR 0,7
      0035 0078 PRINT MENU$(MENUZ,0);
      0036 0078 LOCATE 25, 40-LEN(MENU$(MENUZ,1))/2
      0037 0078 COLOR 7,0
85     0038 0078 PRINT MENU$(MENUZ,1);
      0039 0078 RETURN
      0040 0078
      0041 0078 MENU.OFF:
      0042 0078 LOCATE 22, (MENUZ+10)+10

```

Reagent Jet Printer
Reagent Filling

PAGE 13
07-09-86
15:04:33

Offset Data Source Line IBM Personal Computer BASIC Compiler V2.00

```

5
    OF45 0078      COLOR 14,0
    OF51 0078      PRINT MENUS(MENUZ,0);
    OF6F 0078      LOCATE 25,40-LEN(MENUS(MENUZ,1))/2
    OFA3 0078      PRINT SPACES(LEN(MENUS(MENUZ,1)));
10    OFC8 0078      RETURN
    OFCC 0078
    OFCC 0078      SHOW.ERROR:
    OFD1 0078      ON FLAG% GOSUB ER1, ER2, ER3, ER4
    OFE2 0078      ERRMSG = ERR# + " Strike any key.."
15    OFF2 0080      LOCATE 24,40-LEN(ERRMSG)/2
    1014 0080      COLOR 13,0
    1020 0080      PRINT ERRMSG;
    1029 0080      AS = ""
    1037 0080      WHILE AS = ""
20    1046 0080          AS = INKEY$
    1050 0080      VEND
    1053 0080      GOSUB MESSAGE.OFF
    1059 0080      RETURN
    105D 0080
25    105D 0080      ER1:
    1062 0080          ERR# = REAGNAMES + " Not Found in the Directory"
    1072 0080          RETURN
    1076 0080
    1076 0080      ER2:
30    1078 0080          ERR# = "Reagent Name is too Long (15 characters max.)"
    1085 0080          RETURN
    1089 0080
    1089 0080      ER3:
    109E 0080          ERR# = "Directory is Full (60 reagents max.)"
35    1098 0080          RETURN
    109C 0080
    109C 0080      ER4:
    10A1 0080          ERR# = "Cannot Modify SELECTd reagent Name"
    10AB 0080          RETURN
40    10AF 0080
    10AF 0080      MESSAGE.ON:
    10B4 0080          LOCATE 24,20 - LEN(MESSAGE) / 2:COLOR 11,0:PRINT MESSA
    10EF 0080          GE$;
    10F3 0080          RETURN
45    10F3 0080
    10F3 0080      MESSAGE.OFF:
    10FB 0080          LOCATE 24,1:COLOR 15,0:PRINT SPACES(79);
    1121 0080          RETURN
50    1125 0080
    1125 0080      END SUB
    112C 0080
    11C9 0080

```

55 20426 Bytes Available
45718 Bytes Free

0 Warning Error(s)
0 Severe Error(s)

Resquest Jet Printer
Pattern FilingPAGE 1
07-09-86
15:11:46

IBM Personal Computer BASIC Compiler V2.00

Offset	Data	Source Line
0030	0006	LEN TITLE: 'Resquest Jet Printer' SSUBTITLE: 'Pattern Filing'
0030	0006	MODULE - 'PATFILE' File Handling for patterns
0030	0006	.
0030	0006	AUTHOR - R. A. Ensvold
0030	0006	.
0030	0006	COPYRIGHT (C) 1985 ABBOTT LABORATORIES
0030	0006	.
0030	0006	REVISION - 1.0 02-12-86 NAE Creation of initial code
0030	0006	.
0030	0006	SYSTEM - This code can only be compiled by the BASCOM
0030	0006	COMPILER, it will not run under the INTERPRETER!!
0030	0006	.
0030	0006	DESCRIPTION:
0030	0006	This module allow file handling for patterns. When inv
0030	0006	oked, it displays
0030	0006	the current contents of the pattern directory in 4 colu
0030	0006	ms of 20 entries
0030	0006	each. The pattern which is currently selected for prin
0030	0006	ting is marked by
0030	0006	an asterisk to the left of the pattern name. After the
0030	0006	directory is listed
0030	0006	the user is presented with 5 menu choices. The left an
0030	0006	d right arrows are
0030	0006	used to highlight menu items and the enter key is used
0030	0006	to invoke action.
0030	0006	The menu choices and their actions are:
0030	0006	.
0030	0006	DELETE - Remove a pattern file from the directo
0030	0006	ry
0030	0006	COPY - Copy a pattern file to a new pattern n
0030	0006	ame, saving the old pattern
0030	0006	RENAME - Change the name of the pattern without
0030	0006	changing the pattern itself
0030	0006	SELECT - Select a pattern for printing
0030	0006	EXIT - Return to the main menu
0030	0006	.
0030	0006	DATA DICTIONARY
0030	0006	TYPE1 Which type of valid key was pushed
0030	0006	MENU1 Which menu item is being pointer to (0-4)
0030	0006	DIFF1 Distance to move MENU1 at left or right arro
0030	0006	.
0030	0006	FLAG1 Error type 0-4
0030	0006	POINTER1 Position of PATHNAME1 in directory list
0030	0006	PATHNAME1 Number of pattern names in directory
0030	0006	list
0030	0006	ELENUM1 Number of elements in a pattern file
0030	0006	TEMP1 Storage for integers during pattern copy
0030	0006	I1 Counter used during pattern copy
0030	0006	J1 Counter used during pattern copy
0030	0006	AS Misc. input string
0030	0006	FUNCT1 Printed at bottom of screen during prompt fo
0030	0006	r pattern name
0030	0006	PATHNAME2 Pattern name currently being worked on
0030	0006	SELNAME2 Pattern name currently selected for printing

Reagent Jet Printer
Pattern Filing

PAGE 2
07-09-86
15:11:46

IBM Personal Computer BASIC Compiler V2.00

6

10

15

20

25

Offset	Data	Source Line	
0030	0036	FILES	Filename of pattern data file
0030	0036	FFILES	Filename for source pattern data file used during copy
0030	0036	DFILES	Filename for destination pattern data file used during copy
0030	0036	NEWNAMES	New pattern name for COPY and RENAME
0030	0036	TEMP	Pattern names are held here as the directory is being re-written
0030	0036	NEWFILES	Destination filename used while copying pattern data files
0030	0036	MESSAGE	A message printed at the bottom of the screen
0030	0036	KEYS(4,1)	Array of strings containing the short and long names
0030	0036	ERRMSG	Message printed when any error occurs
0030	0036	ERR	Appended to ERRMSG to indicate nature of error
0030	0036	TEMP	Storage of real variables while copying pattern data files
0030	0036	REN SPACE	

30

Reagent Jet Printer
Pattern Filing

PAGE 3
07-09-86
15:11:46

IBM Personal Computer BASIC Compiler V2.00

35

40

45

50

55

Offset	Data	Source Line	
0030	0006	SUB PATTERN.FILE STATIC	
0047	0006		
0047	0006	GOSUB INITIALIZE	
0040	0006	TYPE1 = 0	
0054	0008		
0054	0008	WHILE TYPE1 (<) 3	
005F	0008	AS = ""	
0069	000C	WHILE AS = ""	
0078	000C	AS = INKEY\$	
0082	000C	WEND	
0083	000C	IF AS = CHR\$(0) + CHR\$(75) THEN TYPE1 = 1:	
00AA	000C	IF AS = CHR\$(0) + CHR\$(77) THEN TYPE1 = 2:	
00CF	000C	IF AS = CHR\$(13) THEN TYPE1 = 3:	
00E7	000C	*(cr) to execute selection	
00E7	000C	ON TYPE1 GOSUB T1, T2, T3	
00F8	000C	WEND	
00FC	000C	EXIT SUB	
0100	000C		
0100	000C	REN SPACE	

Reagent Jet Printer
Pattern Filing

PAGE 4
07-09-86
15:11:46

Offset Date Source Line IEN Personal Computer BASIC Compiler V2.00

```

0100 000C  '***** SUB-ROUTINES FOR THIS MODULE *****
0100 000C
0100 000C T1:      'left arrow
25 0103 000C      TYPE1 = 0
010C 000C      IF MENUZ = 0 THEN RETURN
011B 000C      DIFF1 = -1
0122 0010      GOSUB NEW.MENU
012B 0010      RETURN
30 012C 0010
012C 0010 T2:      'right arrow
0131 0010      TYPE1 = 0
013B 0010      IF MENUZ = 4 THEN RETURN
0147 0010      DIFF1 = 1
35 014E 0010      GOSUB NEW.MENU
0154 0010      RETURN
015B 0010
015B 0010 T3:      '(cr) (execute selected menu item)
015D 0010      LOCATE 25,1:PRINT SPACES(79);
40 017A 0010      ON MENUZ + 1 GOSUB T3A, T3B, T3C, T3D, T3E
018F 0010      GOSUB MENU.ON
019C 0010      RETURN
0199 0010
45 0199 0010      AEX SPACE

```


Offset	Data	Source Line
0199	0010	T2A: delete pattern
019E	0010	TYPE2 = 0
01A5	0010	FLAG2 = "Delete"
01AF	0014	GOSUB GET.SOURCE
01B5	0014	IF LEN(PATNAME) = 0 THEN RETURN
01C7	0018	IF PATNAME = SELNAME THEN FLAG2 = 1:GOSUB SHOW.ERROR:
		RETURN
01E7	001E	GOSUB SEARCH
01ED	001E	IF POINT2 = 0 THEN FLAG2 = 1:GOSUB SHOW.ERROR:RETURN
0209	0020	
020F	0020	MESSAGE = "Deleting " + PATNAME + " Please Wait..
0220	0024	GOSUB MESSAGE.ON
0226	0024	
0226	0024	'rewrite directory deleting PATNAME as indicat
		ed by POINT2
0226	0024	KILL "PATDIR.OLD"
0220	0024	NAME "PATDIR.RJP" AS "PATDIR.OLD"
0237	0024	OPEN "PATDIR.OLD" FOR INPUT AS #1
0248	0024	OPEN "PATDIR.RJP" FOR OUTPUT AS #2
025A	0024	
025A	0024	INPUT #1, PATNAME
026C	0026	PATNAME = PATNAME - 1
0275	0026	WRITE #2, PATNAME
0286	0026	
0286	0026	IF PATNAME = 0 THEN GOTO DIR.DONE
0295	0026	FOR I2 = 1 TO PATNAME + 1
02A4	0028	INPUT #1, PATNAME
02B6	0028	IF I2 < POINT2 THEN PRINT #2, PATNAME
02B5	002A	NEXT I2
02E5	002A	
02E5	002A	DIR.DONE:
02EA	002A	CLOSE #1:CLOSE #2
02F8	002A	
02F8	002A	'remove data file
02F8	002A	FILES = RIGHTS(STR\$(POINT2), LEN(STR\$(POINT2)) - 1) +
		"PAT.RJP"
031C	002E	KILL FILES
0373	007E	
0373	007E	'rename remaining data files to maintain linked
		list with directory
0373	002E	WHILE (PATNAME + 1) > POINT2
0383	002E	SFILES = RIGHTS(STR\$(POINT2+1), LEN(STR\$(POINT
		2+1)) - 1) + "PAT.RJP"
0397	0032	DFILES = RIGHTS(STR\$(POINT2), LEN(STR\$(POINT
		2)) - 1) + "PAT.RJP"
0370	0036	NAME SFILES AS DFILES
0387	0036	POINT2 = POINT2 + 1
0396	0036	
0393	0036	WEND
0393	0036	GOSUB MESSAGE.OFF
0399	0036	PATNAME = SELNAME
03A3	0036	GOSUB T2DA
03A9	0036	GOSUB DISP.DIR

8

10

15

20

25

Reagent Jet Printer
Pattern Filing

PAGE 6
07-09-86
15:11:46

Offset Data Source Line

IBM Personal Computer BASIC Compiler V2.00

30

03AF 0036 RETURN
03B3 0036
03B3 0036 REM IPAGE

35

40

45

50

55

Request: Jet Printer
Pattern FilingPAGE 7
07-09-86
12:11:46

Offset Data Source Line 125 Personal Computer BASIC Compiler V2.00

```

8      0383 003A   125:  'copy pattern
      0388 003A      TYPEZ = 0
      038F 003A      IF PATHNZ = 80 THEN FLAGZ = 3:GOSUB SHOW.ERROR:RETURN
10     0398 003A      FUNCTS = "Copy"
      03E5 003A      GOSUB GET.SOURCE
      03ED 003A      IF LEN(NEWNAME) = 0 THEN RETURN
      03F5 003A      GOSUB SEARCH
      0403 003A      IF POINTERZ = 0 THEN FLAGZ = 1:GOSUB SHOW.ERROR:RETURN
15     041F 003A      GOSUB GET.NEW.NAME
      0425 003A      IF LEN(NEWNAME) = 0 THEN RETURN
      0437 003A      IF LEN(NEWNAME) > 15 THEN FLAGZ = 2:GOSUB SHOW.ERROR:R
      RETURN
20     0457 003A      MESSAGEZ = "Copying " + PATHNAMEZ + " to " + NEWNAMEZ +
      0457 003A      " Please wait..."
      GOSUB MESSAGE.CH
      047C 003A      'add NEWNAMEZ at end of directory
25     0482 003A      KILL "PATDIR.OLD"
      0482 003A      MAKE "PATDIR.RJP" AS "PATDIR.OLD"
      0489 003A      OPEN "PATDIR.OLD" FOR INPUT AS #1
      0493 003A      OPEN "PATDIR.RJP" FOR OUTPUT AS #2
      04A4 003A
      04B6 003A
30     04B6 003A      INPUT #1, PATHNZ
      04C8 003A      PATHNZ = PATHNZ + 1
      04D1 003A      WRITE #2,PATHNZ
      04E2 003A
      04E2 003A      FOR IZ = 1 TO PATHNZ - 1
35     04F1 003C          INPUT #1,TEMPZ
      0503 0040          PRINT #2,TEMPZ
      0513 0040      NEXT IZ
      0525 0040      PRINT #2,NEWNAMEZ
      0535 0040
40     0535 0040      CLOSE #1:CLOSE #2
      0543 0040
      0543 0040      'create copy of pattern data file
      0543 0040      FILES = RIGHTS(STR$(POINTERZ),LEN(STR$(POINTERZ))-1) +
45     0547 0040      "PAT.RJP"
      NEWFILES = RIGHTS(STR$(PATHNZ),LEN(STR$(PATHNZ))-1) +
      "PAT.RJP"
      058B 0044      OPEN FILES FOR INPUT AS #1
      058B 0044      OPEN NEWFILES FOR OUTPUT AS #2
50     059C 0044
      05AE 0044
      05AE 0044      INPUT #1,ELXNZ
      05C9 0046      WRITE #2,ELXNZ
      05D1 0046
      05D1 0046      FOR IZ = 1 TO 4
55     05D8 0046          INPUT #1,TEMP
      05EA 004A          WRITE #2,TEMP
      05FA 004A      NEXT IZ
      060A 004A
      060A 004A      FOR IZ = 1 TO ELXNZ

```

Reagent Jet Printer
Pattern Filing

PAGE 9

07-09-86

15:11:46

Offset Data Source Line IBM Personal Computer BASIC Console V2.00

0842 0052 RETURN
0846 0052
0846 0052 REM SPAGE

Reagent Jet Printer
Pattern Filing

PAGE 10

07-09-86

15:11:46

Offset Data Source Line IBM Personal Computer BASIC Console V2.00

0846 0052 TJD: 'select pattern for printing
0848 0052 TYPE1 = 0
0852 0052 FUNCT1 = 'Select'
085C 0052 GOSUB GET.SOURCE
0862 0052 IF LEN(PATNAMES) = 0 THEN RETURN
0874 0052 IF PATNAMES = SELNAMES THEN RETURN
0887 0052 GOSUB T3DA
088D 0052 GOSUB DISP.DIR
0893 0052 RETURN
0897 0052
0897 0052 T3DA:
089C 0052 GOSUB SEARCH
08A2 0052 IF POINTER1 = 0 THEN FLAG1 = 1:GOSUB SHOW.ERROR:RETURN
08BE 0052
08C2 0052 MESSAGE1 = 'Selecting ' + PATNAMES + ' Please Wait.
..
08D5 0052 GOSUB MESSAGE.ON
08DB 0052
08DB 0052 'change entries in pattern default file PATDEF.R
JP
08DB 0052 OPEN 'PATDEF.RJP' FOR OUTPUT AS #1
08ED 0052 FILES = RIGHT\$(STR\$(POINTER1),LEN(STR\$(POINTER1))-1) +
'PAT.RJP'
0911 0052
0911 0052 PRINT #1,FILES
0921 0052 PRINT #1,PATNAMES
0931 0052
0931 0052 CLOSE #1
0938 0052 GOSUB MESSAGE.OFF
093E 0052 RETURN
0942 0052
0942 0052 T3E: 'exit pattern filing
0947 0052 RETURN
0948 0052
0948 0052 REM SPAGE

Request Jet Printer
Pattern Filter

PAGE 11
07-09-86
15:11:46

Offset Data Source Line IBM Personal Computer BASIC Console V2.00

```

5      0948 0052 SEARCH:
      0950 0052     POINTER1 = 0
      0957 0052     OPEN "PATDIR.R2P" FOR INPUT AS #1
      0960 0052     INPUT #1,PATNUM1:      get number of patterns in direc
10      097A 0052     lory
      097A 0052     IF PATNUM1 = 0 THEN CLOSE #1:RETURN
      0979 0052     TEMP1 = ""
      097A 0052     WHILE (POINTER1 < PATNUM1) AND (PATNUM1 < ) TEMP1
      097C 0052         LINE INPUT #1,TEMP1
      097F 0052         POINTER1 = POINTER1 + 1
15      0988 0052     NEXT
      0988 0052     IF PATNUM1 < ) TEMP1 THEN POINTER1 = 0
      09F1 0052     CLOSE #1
      09F8 0052     RETURN
20      09FC 0052
      09FC 0052 GET.SOURCE:
      0A01 0052     LOCATE 25,1:COLOR 15,0:PRINT "Enter Pattern Name to 'FU
      0A33 0052     NEXTS" ";
      0A41 0052     LINE INPUT: "",PATNUM1
      0A5E 0052     LOCATE 25,1:PRINT SPACES(79);
      0A62 0052     RETURN
      0A62 0052 GET.NEW.NAME:
      0A67 0052     LOCATE 25,1:COLOR 15,0:PRINT "Enter New Pattern Name ";
30      0A8D 0052     LINE INPUT: "",SELNAME1
      0A98 0052     LOCATE 25,1:PRINT SPACES(79);
      0A98 0052     RETURN
      0ABC 0052
      0ABC 0052 DISP.DIR:      'display directory in 4 columns, 20 rows
      0AC1 0052      'read default pattern name into SELNAME1
      0AC1 0052     OPEN "PATDEF.F2P" FOR INPUT AS #1
      0AD2 0052     INPUT #1,SELNAME1:      'discard data file name
      0AE4 0052     INPUT #1,SELNAME1
      0AF6 0052     CLOSE #1
40      0AFD 0052
      0AFD 0052     OPEN "PATDIR.R2P" FOR INPUT AS #1
      0B0E 0052     INPUT #1,PATNUM1:      read number of patterns
      0B20 0052
      0B20 0052     MESSAGE1 = "Reading Pattern Directory Please Wait"
      0B2A 0052     GOSUB MESSAGE.CH
      0B30 0052     FLAG1 = 0
      0B37 0052     TEMP1 = PATNUM1 - 1:IF PATNUM1 < 80 THEN TEMP1 = PATNUM
50      0B52 0052     1
      0B52 0052     FOR I1 = 0 TO TEMP1
      0B5E 0054         LOCATE (I1 MOD 20)+1,(INT(I1/20)+20)+1
      0B91 0054         PRINT SPACES(118);
      0BA1 0054     NEXT I1
      0B83 0054
      0B83 0054     FOR I1 = 0 TO PATNUM1 - 1
      0BC1 0054         INPUT #1,PATNAME1
      0BD3 0054         LOCATE (I1 MOD 20)+1,(INT(I1/20)+20)+3
      0CD6 0054         PRINT PATNAME1;
      0C13 0054         IF PATNAME1 = SELNAME1 THEN LOCATE (I1 MOD 20)+
65      1,(INT(I1/20)+20)+1:PRINT "*";

```

Request Jet Printer
Pattern Filling

PAGE 12
07-09-86
15:11:46

IBM Personal Computer BASIC Compiler V2.00

Offset	Data	Source Line
0C62	0056	NETT 12
0C77	0056	CLOSE 01
0C7E	0056	GOSUB MESSAGE.OFF
0C94	0056	RETURN
0C96	0056	
0C98	0056	
0C98	0056	INITIALIZE:
0C9D	0056	DIM MENU(4,1)
0C9E	007E	MENU(0,0) = "Delete"
0CA6	007E	MENU(0,1) = "Remove a pattern file from the directory"
0CC1	007E	MENU(1,0) = "Copy"
0CDC	007E	MENU(1,1) = "Copy a pattern file to a new pattern name"
0CF3	007E	MENU(2,0) = "Rename"
0D12	007E	MENU(2,1) = "Rename a pattern file in the directory"
0D30	007E	MENU(3,0) = "Select"
0D4B	007E	MENU(3,1) = "Select a pattern file to be printed"
0D67	007E	MENU(4,0) = "Exit"
0D82	007E	MENU(4,1) = "Return to the main menu"
0D9E	007E	
0D9E	007E	COLOR 9,0:CLS
0DB1	007E	LOCATE 21,1
0DBE	007E	FOR IZ = 1 TO 80
0DC5	007E	PRINT "0";
0DB2	007E	NEXT IZ
0DE2	007E	
0DE2	007E	FOR MENU = 0 TO 4
0DEB	007E	GOSUB MENU.OFF
0DEE	007E	NEXT MENU
0DFE	007E	
0DFE	007E	GOSUB DISP.DIR
0E04	007E	IF FLAG1 > 0 THEN GOSUB SHOW.ERROR
0E13	007E	MENU = 4
0E1C	007E	GOSUB MENU.ON
0E22	007E	
0E22	007E	RETURN
0E26	007E	
0E26	007E	MENU.MENU:
0E2B	007E	GOSUB MENU.OFF
0E31	007E	MENU = MENU + DIFF1
0E3B	007E	GOSUB MENU.ON
0E43	007E	RETURN
0E47	007E	
0E47	007E	MENU.ON:
0E4C	007E	LOCATE 22,(MENU+10)+18
0E63	007E	COLOR 0,7
0E6F	007E	PRINT MENU(MENU,0);
0EBD	007E	LOCATE 25,40-LEN(MENU(MENU,1))/2
0EC1	007E	COLOR 7,0
0EC9	007E	PRINT MENU(MENU,1);
0EEC	007E	RETURN
0EF0	007E	
0EF0	007E	MENU.OFF:
0EF3	007E	LOCATE 22,(MENU+10)+18
0F0C	007E	COLOR 14,0

Reagent Jet Printer
Pattern Filing

PAGE 13
07-09-86
13:11:46

Offset	Data	Source Line	IBM Personal Computer BASIC Compiler V2.00
0F18	007E	PRINT XENUS(XENUS,0);	
0F36	007E	LOCATE 25,10-LEN(XENUS(XENUS,1))/2	
0F6A	007E	PRINT SPACE\$(LEN(XENUS(XENUS,1)));	
0F8F	007E	RETURN	
0F93	007E		
0F93	007E	SHOW ERROR:	
0F98	007E	ON FLAG% GOSUB ER1, ER2, ER3, ER4	
0FA9	007E	ERRMSG = ERR# + " Strike any key.."	
0FB9	0086	LOCATE 24,10-LEN(ERRMSG)/2	
0FB9	0086	COLOR 13,0	
0FE7	0086	PRINT ERRMSG;	
0FF4	0086	AS = ""	
0FFE	0086	WHILE AS = ""	
1009	0086	AS = INKEY\$	
1017	0086	WEND	
101A	0086	GOSUB MESSAGE.OFF	
1020	0086	RETURN	
1024	0086		
1024	0086	ER1:	
1029	0086	ERR# = PATHNAME + " Not Found in the Directory"	
1039	0086	RETURN	
103D	0086		
103D	0086	ER2:	
1042	0086	ERR# = "Pattern Name is too Long (15 characters max.)"	
104C	0086	RETURN	
1050	0086		
1050	0086	ER3:	
1055	0086	ERR# = "Directory is Full (80 patterns max.)"	
105F	0086	RETURN	
1063	0086		
1063	0086	ER4:	
1068	0086	ERR# = "Cannot Modify SELECTd pattern Name"	
1072	0086	RETURN	
1076	0086		
1076	0086	MESSAGE.ON:	
1078	0086	LOCATE 24,20 - LEN(MESSAGE) / 2:COLOR 11,0:PRINT MESSA	
1086	0086	GE\$;	
1086	0086	RETURN	
108A	0086		
108A	0086		
108A	0086	MESSAGE.OFF:	
108F	0086	LOCATE 24,1:COLOR 15,0:PRINT SPACE\$(79);	
10EB	0086	RETURN	
10EC	0086		
10EC	0086	END SUB	
10F3	0086		
1688	0086		

30426 Bytes Available
45670 Bytes Free

0 Warning Error(s)
0 Severe Error(s)

Reagent Jet Printer
Main Line Code

PAGE 1
07-09-86
13:27:04
IBM Personal Computer BASIC Compiler V2.00

```

5      0030 0006 REM $TITLE: 'Reagent Jet Printer' $SUSTITLE: 'Main Line Code'
      0030 0006
      0030 0006 'MODULE - 'MAIN'
      0030 0006
10     0030 0006 'AUTHOR - M. A. Enevold
      0030 0006
      0030 0006 'COPYRIGHT (C) 1986 ABBOTT LABORATORIES
      0030 0006
      0030 0006 'REVISION - 1.1 02-19-86 RAE Add notes and revise TYPEZ resetin
15     0030 0006 '
      0030 0006 ' - 1.0 02-14-86 RAE Creation of initial code
      0030 0006
      0030 0006 'SYSTEM - This code can only be compiled by the BASCOM
      0030 0006 ' COMPILER, it will not run under the INTERPRETER!!
20     0030 0006
      0030 0006 'DESCRIPTION
      0030 0006 ' This is the main controlling module for the Reagent Jet
      0030 0006 ' Printer.
25     0030 0006 ' It displays a menu in table form that allows 4 function
      0030 0006 ' s to be
      0030 0006 ' selected. PATTERN DEFINITION allows the user to define
      0030 0006 ' patterns
      0030 0006 ' to be printed. PATTERN FILING lets the user delete, co
30     0030 0006 ' py, rename
      0030 0006 ' and select patterns for printing. REAGENT CALIBRATION
      0030 0006 ' permits setting
      0030 0006 ' of operation parameters for different reagents. REAGEN
      0030 0006 ' T FILING is
35     0030 0006 ' the same as pattern filing. PRINTING PRINT prints the
      0030 0006 ' selected
      0030 0006 ' pattern with the selected reagent. SYSTEM EXIT TO DOS
      0030 0006 ' ends the session.
      0030 0006 ' Using up and down arrow keys let the user move through
40     0030 0006 ' the menu and
      0030 0006 ' the Enter (cr) key activates the selection.
      0030 0006
      0030 0006 'DATA DICTIONARY
      0030 0006 '
45     0030 0006 ' MENUZ This value represents the current menu
      0030 0006 ' item (0-5)
      0030 0006 ' MENU$(5,1) String array for displaying menu items.
      0030 0006 ' 6 rows by 2 columns
      0030 0006 '
      0030 0006 ' Each row corresponds to a menu item (0-
50     0030 0006 ' 5)
      0030 0006 ' First column is short menu name in high
      0030 0006 ' lighted area
      0030 0006 ' Second column is long description displ
      0030 0006 ' ayed at menu bottom
      0030 0006 ' ARROW$(5) This array stores to row in which the s
      0030 0006 ' hort menu name will be displayed
65     0030 0006 ' DIFFL This value is used it change MENUZ in r
      0030 0006 ' esponse to arrow keys
      0030 0006 ' TYPEZ This value is set based on which valid
      0030 0006 ' key is pressed
      0030 0006 '
      0030 0006 ' 0 = No valid key. 1 = Up Arrow. 2 = D

```


Reagent Jet Printer
Main Line Code

PAGE 2
07-09-86
15:27:04

Offset Data Source Line IBM Personal Computer BASIC Compiler V2.00

6

10

15

20

```

own Arrow. J = (cr).
      TEMP:      Used to store REMUC while screen is ref
reshed
      AS         Used to store single input keystrokes
      CS         Used to store special graphics characte
rs used in drawing the menu table
      IX         Counter used to refresh display
      RX         Row in which special graphics character
is displayed
      CX         Column in which special graphics charac
ter is displayed
      REM SPAGE

```

Reagent Jet Printer
Main Line Code

PAGE 3
07-09-86
15:27:04

Offset Data Source Line IBM Personal Computer BASIC Compiler V2.00

25

30

35

40

45

50

55

```

0030 0006
0030 0006 Main-line code for RJP Reagent Jet Printer
0030 0006
0030 0006 MAIN.LINE.CODE:
0030 0006
0030 0006 GOSUB INITIALIZE
0040 0006
0040 0006 WHILE TYPE1 (<) J
0050 0006
0050 0006 TYPE1 = 0
0050 0006 AS = ""
0060 0006 WHILE AS = ""
0060 0006 AS = INKEY$
0060 0006 WEND
0070 0006
0070 0006 IF AS = CHR$(0) + CHR$(72) THEN TYPE1 = 1:
up arrow
0080 0006
0080 0006 IF AS = CHR$(0) + CHR$(80) THEN TYPE1 = 2:
down arrow
0090 0006
0090 0006 IF AS = CHR$(13) THEN TYPE1 = 3:
(cr) execute command
00E7 000C
00E7 000C ON TYPE1 GOSUB T1, T2, T3
00F0 000C
00F0 000C WEND
00F0 000C
00FA 000C CLS
0101 000C COLOR 7,0,0
0112 000C SYSTEM
0110 000C
0110 000C REM SPAGE

```

Reagent Jet Printer
Main Line Code

PAGE 4

07-09-86

13:27:04

IBM Personal Computer BASIC Compiler V2.00

Offset	Data	Source Line
0116	000C	***** SUB-ROUTINES FOR MAIN PROGRAM
0116	000C	T1: 'up arrow
0118	000C	IF MENUZ = 0 THEN RETURN
012A	000E	DIFFZ = -1
0131	0010	GOSUB NEW.MENU
0137	0010	RETURN
013B	0010	
013B	0010	T2: 'down arrow
0140	0010	IF MENUZ = 5 THEN RETURN
014F	0010	DIFFZ = 1
0156	0010	GOSUB NEW.MENU
015C	0010	RETURN
0160	0010	
0160	0010	T3: 'reset calibration
0163	0010	ON MENUZ + 1 GOSUB T31, T32, T33, T34, T35, T36
017C	0010	IF MENUZ < 5 THEN TYPEZ = 0: 'reset TYPEZ so program
		won't end
018E	0010	SCREEN 0,0,0,3
01A5	0010	RETURN
01A9	0010	
01A9	0010	T31: 'pattern definition
01AE	0010	CALL PATENTRY: 'in module PATENT
01BA	0010	GOSUB REFRESH
01C0	0010	RETURN
01C4	0010	
01C4	0010	T32: 'pattern filing
01C9	0010	SCREEN 0,0,0,0:CLS
01E3	0010	CALL PATTERN.FILE: 'in module PATFILE
01F1	0010	RETURN
01F3	0010	
01F3	0010	T33: 'reagent calibration
01FA	0010	CALL REAGENT.CALIBRATE: 'in module REACAL
0206	0010	RETURN
020A	0010	
020A	0010	T34: 'reagent filing menu
020F	0010	SCREEN 0,0,0,0:CLS
0223	0010	CALL REAGENT.FILE: 'in module REAFILE
0237	0010	RETURN
023B	0010	
023B	0010	T35: 'print pattern
0240	0010	CALL PATPRINT: 'in module PATPRINT
024C	0010	RETURN
0250	0010	
0250	0010	T36: 'exit system, don't reset TYPEZ
0253	0010	RETURN
0259	0010	
0259	0010	REM SPAGE

Seagor Jet Printer
Main Line Code

PAGE 5
07-09-86
15:27:04

IBM Personal Computer BASIC Compiler V2.00

Offset	Data	Source Line
0239	0010	KEY.MENU:
023E	0010	RESTORE MENU.OFF
0244	0010	MENU1 = MENU2 + DIFF1
0270	0010	POSITIVE MENU1 ON
0276	0010	RETURN
027A	0010	
027A	0010	INITIALIZE:
027F	0010	CALL PCI.INT1
0283	0010	
0288	0010	define and initialize arrays
028B	0010	DIM MENU2(5)
028C	0010	MENU2(0) = 4
029E	0010	MENU2(1) = 6
02B1	0010	MENU2(2) = 10
02C4	0010	MENU2(3) = 12
02D7	0010	MENU2(4) = 16
02EA	0010	MENU2(5) = 20
02FD	0010	
02FD	0010	DIM MENU3(5,1)
02FE	0010	RESTORE MENU.STRING.DATA
0303	0010	FOR IZ = 0 TO 5
0308	0010	READ MENU3(IZ,0),MENU3(IZ,1)
0313	0010	NEXT IZ
0318	0010	
0318	0010	set initial values into variables
0318	0010	TYPE1 = 0
0332	0010	MENU1 = 0
0339	0010	
0339	0010	REFRESH: redraw screen and highlight current menu selection
033E	0010	
033E	0010	SCREEN 0,0,0:CLS:COLOR 7,0,0
038B	0010	LOCATE 10,32:PRINT "Loading Menu....."
03A5	0010	SCREEN 0,0,0:CLS
03C2	0010	
03C2	0010	
03C2	0010	COLOR 13,0
03CE	0010	LOCATE 1,3:
03DB	0010	PRINT "REAGENT JET PRINTER";
03E8	0010	CLS:CLS 10,0
03F4	0010	LOCATE 5,26
0401	0010	PRINT "PATTERN"
040E	0010	LOCATE 11,26
0413	0010	PRINT "REAGENT"
0429	0010	LOCATE 16,26
0433	0010	PRINT "PRINTING"
0442	0010	LOCATE 20,27
044F	0010	PRINT "SYSTEM"
045C	0010	
045C	0010	draw the menu table in special graphics characters
045C	0010	COLOR 9,0
0468	0010	FOR IZ = 10 TO 63
046F	0010	LOCATE 2,IZ:PRINT "0";
048A	0010	LOCATE 9,IZ:PRINT "0";
04A5	0010	LOCATE 16,IZ:PRINT "0";

Requiel Jet Printer
Main Line Code

PAGE 6
07-09-86
15:27:04
IBM Personal Computer BASIC Compiler V2.00

```

6      Offset Data Source Line
      04C0 004E LOCATE 18,15:PRINT "D";
      04D0 004E LOCATE 22,15:PRINT "D";
      04F6 004E LOCATE 24,15:PRINT "D";
      0511 004E NEXT IZ
10     0524 004E FOR IZ = 3 TO 23
      0528 004E LOCATE 12,17:PRINT "J";
      0546 004E LOCATE 12,64:PRINT "J";
      0561 004E NEXT IZ
      0571 004E RESTORE TABLE
15     0578 004E FOR IZ = 1 TO 12
      057F 004E READ RZ,CZ,C5
      0592 0056 LOCATE RZ,CZ:PRINT C5;
      05A6 0056 NEXT IZ
      05BE 0056
20     056E 0056 print the instructions
      05BE 0056 COLOR 7,0
      05CA 0056 LOCATE 25,6
      05D7 0056 PRINT "Use or to highlight menu items. Use to
      activate selection.";
25     05E4 0056
      05E4 0056 COLOR 15,0
      060A 0056 LOCATE 25,15:PRINT "";
      0624 0056 LOCATE 25,67:PRINT "DT";
30     063E 0056
      063E 0056 display the 6 menu choices
      065E 0056 TEMP1 = MENUZ
      0645 0058 FOR MENUZ = 0 TO 5
      064B 0058 GOSUB MENU.CFF
35     0651 0058 NEXT MENUZ
      0661 0058 MENUZ = TEMP1
      0668 0058
      0668 0058 highlight the currently active menu item
      0668 0058 GOSUB MENU.ON
40     066E 0058
      066E 0058 SCREEN 0,0,3,3
      0685 0058 RETURN
      0687 0058
      0687 0058 MENU.ON: highlight the menu MENUZ and display its long description
45     068E 0058
      068E 0058 COLOR 0,7
      0698 0058 LOCATE ARROW(MENUZ),52-LEN(MENU(MENUZ,0))/2
      06DA 0058 PRINT MENU(MENUZ,0);
      06FB 0058 COLOR 7,0
50     0704 0058 LOCATE 23,40.5-LEN(MENU(MENUZ,1))/2
      0738 0058 PRINT MENU(MENUZ,1);
      0757 0058 RETURN
      075B 0058
      075B 0058 MENU.OFF: un-highlight menu MENUZ and erase long description
55     0760 0058
      0760 0058 COLOR 14,0
      076C 0058 LOCATE ARROW(MENUZ),52-LEN(MENU(MENUZ,0))/2
      07AC 0058 PRINT MENU(MENUZ,0);
      07CA 0058 COLOR 7,0
      07DB 0058 LOCATE 23,40.5-LEN(MENU(MENUZ,1))/2

```

6

10

15

20

25

Reagent Jet Printer
Main Line Code

PAGE 7
07-09-86
13:27:04

Offset Data Source Line IBM Personal Computer BASIC Compiler V2.00

30

060A 005B PRINT SPACES(LEN(MENU\$)-MENU\$,1));
062F 005B RETURN
0833 005B
0833 005B REM SPACE

35

40

45

50

55

```

8      Offset Data Source Line
      0633 0038 ***** DATA FIELDS USED BY THE MAIN PROGRAM *****
      0633 0038
10     0633 0038 RESU.STRINGS.DATA: "first entry is user name, second is lo
      sq description
      0838 0038 DATA "DEFINITION", "Create and Modify Patterns"
      0838 0038 DATA "FILINGS", "Delete, Copy, Rename, and Select Pa
15     0838 0038 tterns"
      083C 0038 DATA "CALIBRATION", "Calibrate and Modify Reagent Profil
      es"
      083E 0038 DATA "FILINGS", "Delete, Copy, Rename, and Select Re
20     0840 0038 agents"
      0840 0038 DATA "PRINT", "Print Selected Pattern with Selecte
      d Reagent"
      0842 0038 DATA "EXIT TO DOS", "Leave Program and Return to DOS"
      0844 0038
      0844 0038 TABLE: "first entry is row, second is column, third is special
25     graphics character
      0849 0038
      0849 0038 DATA 2,17,"?"
      084B 0038 DATA 2,64,"?"
      084B 0038 DATA 8,17,"C"
      084F 0038 DATA 8,64,"I"
30     0851 0038 DATA 14,17,"C"
      0853 0038 DATA 14,64,"I"
      0855 0038 DATA 18,17,"C"
      0857 0038 DATA 18,64,"I"
      0859 0038 DATA 22,17,"C"
35     085B 0038 DATA 22,64,"I"
      085D 0038 DATA 24,17,"I"
      085F 0038 DATA 24,64,"I"
      0861 0038
      0861 0038 END
40     0863 0038
      0862 0038

```

50426 Bytes Available
47680 Bytes Free

0 Warning Error(s)
0 Severe Error(s)

50 Claims

1. A dispensing system for use in diagnostic instruments for precise metering of a desired diagnostic fluid, the system comprising:
 - 55 a jetting chamber defining a volume and comprising a first and second aperture, the first aperture adapted to receive diagnostic fluid, the second aperture defining an orifice;
 - a transducer in mechanical communication with the jetting chamber, the transducer operative to alternately expand and de-expand the volume of the jetting chamber in response to a selected electrical pulse and

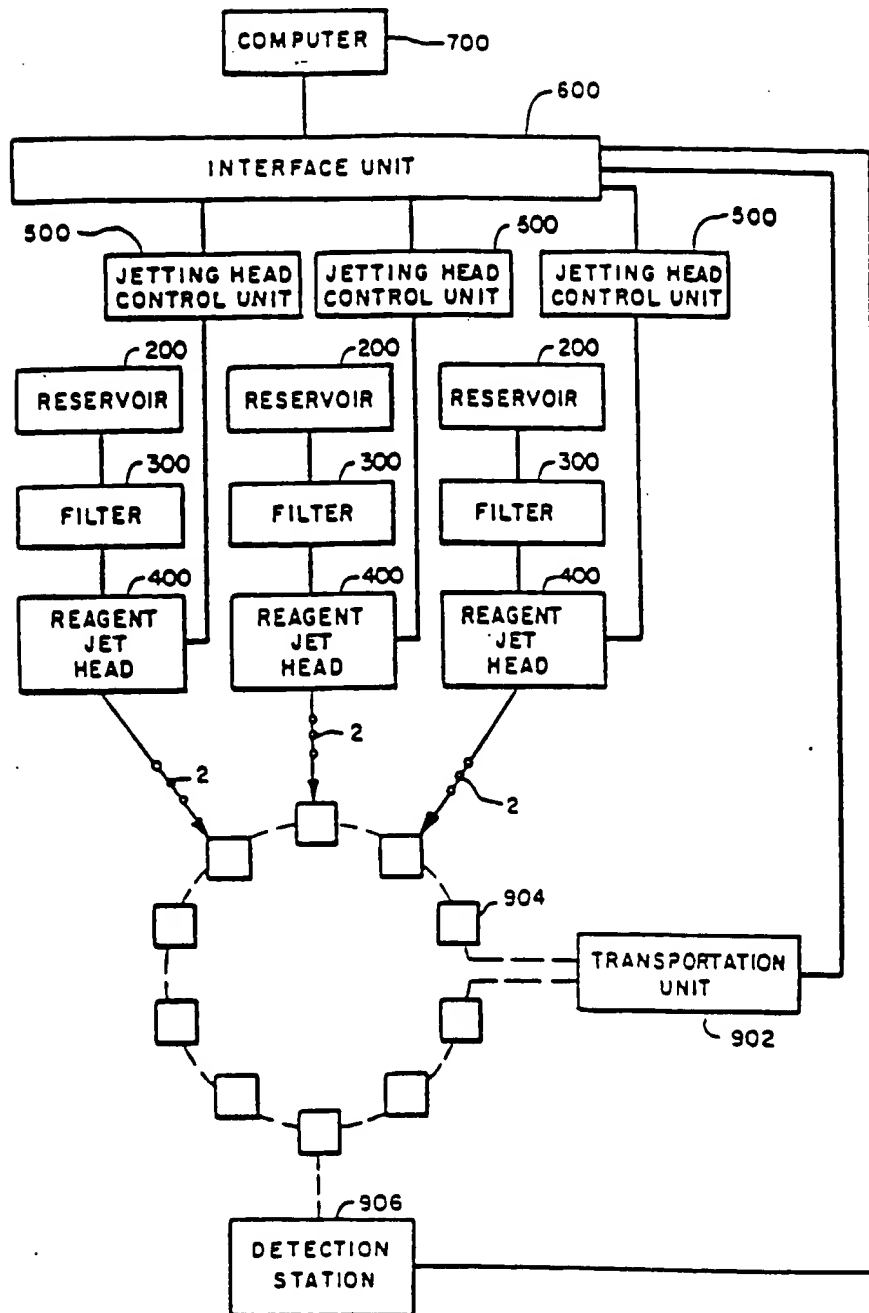
thereby cause the jetting chamber to emit a substantially uniformly sized droplet of diagnostic fluid through the orifice; and
means for generating a number of electrical pulses sufficient to cause a desired quantity of the diagnostic fluid to be dispensed.

- 5 2. The invention of Claim 1 wherein the system further comprises:
at least one additional jetting chamber in fluid communication with an additional diagnostic fluid;
at least one additional transducer in mechanical communication with the additional jetting chamber;
at least one additional means for applying an electrical pulse to the additional transducer;
means for generating respective numbers of electrical pulses sufficient to cause precise quantities of the
10 diagnostic fluids to be dispensed in a desired volumetric ratio; and
a receptacle adapted for and positioned to receive the fluids.
3. The invention of Claim 1 wherein the system further comprises:
means for directing at least one of (1) the receptacle and (2) the emitted diagnostic fluid and the emitted
15 additional diagnostic fluid such that desired quantities of the fluids are dispensed into the receptacle in a
predefined dispensing order.
4. The invention of Claim 1 wherein one of the diagnostic fluids comprises serum and wherein the
jetting chambers cooperate such that the other diagnostic fluid is emitted in a manner to contact and mix
with the serum.
5. The invention of Claim 1 wherein the jetting chamber comprises a cylindrical tube and wherein the
20 transducer is mounted concentrically about the cylindrical tube.
6. The invention of Claim 1 wherein the jetting chamber is conically shaped.
7. The invention of Claim 1 wherein the jetting chamber comprises at least one chamber wall which is
integrally formed with the transducer.
8. The invention of Claim 1 wherein the transducer is one of (1) a piezo-electric transducer; (2) a
25 magneto-strictive transducer; (3) an electro-strictive transducer; and (4) an electro-mechanical transducer.
9. The invention of Claim 1 wherein the jetting chamber is conically shaped; and wherein the transducer
is disc shaped and forms the base of the conically shaped jetting chamber.
10. The invention of Claim 1 wherein the orifice comprises an end face and the end face is coated with
a hydrophobic polymer.
- 30 11. The invention of Claim 1 wherein the transducer is cylindrically shaped and comprises a first
electrode located on the inner wall of the cylinder and wraps around one end of the cylinder and wherein a
second electrode is located substantially on the outer wall of the cylinder and is electrically isolated from
the first electrode.
12. The invention of Claim 1 wherein the means for generating produces an electrical pulse of selected
35 rise and fall time constants and of selected duration, voltage and polarity.
13. The invention of Claim 1 wherein the means for generating the electrical pulse comprises means for
scaling the voltage of the pulse in response to a selectable digital value.
14. The invention of Claim 1 wherein the apparatus further comprises means for directing the emitted
diagnostic fluid along a desired path.
- 40 15. A method of dispensing precise quantities of diagnostic fluids comprising the steps of:
(a) generating an electrical pulse of predefined characteristics;
(b) reducing the volume of a chamber containing the diagnostic fluid by electro-mechanical means in
response to the electrical pulse such that a droplet of fluid of known volume is propelled through an orifice
in the chamber; and
45 (c) repeating steps (a) and (b) until a desired quantity of the diagnostic fluid has been dispensed

50

55

FIG. 1



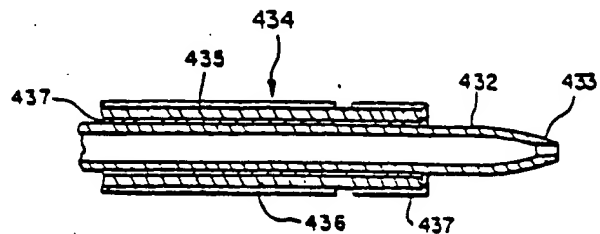
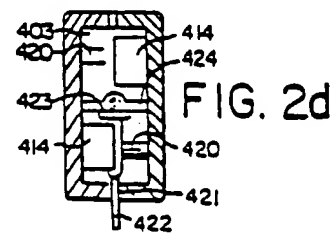
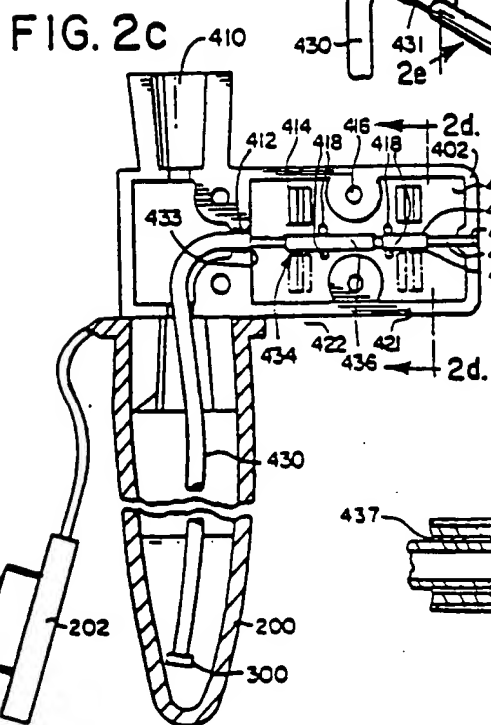
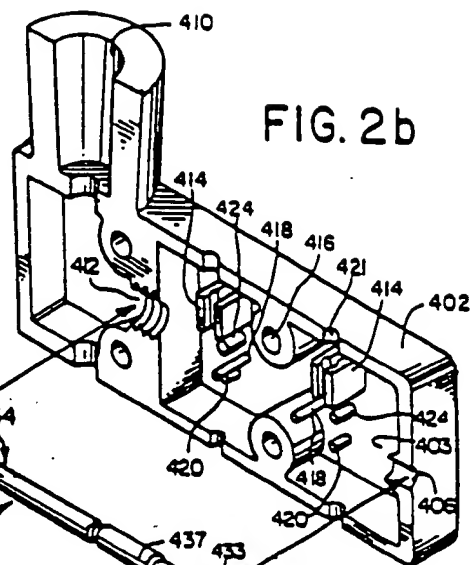
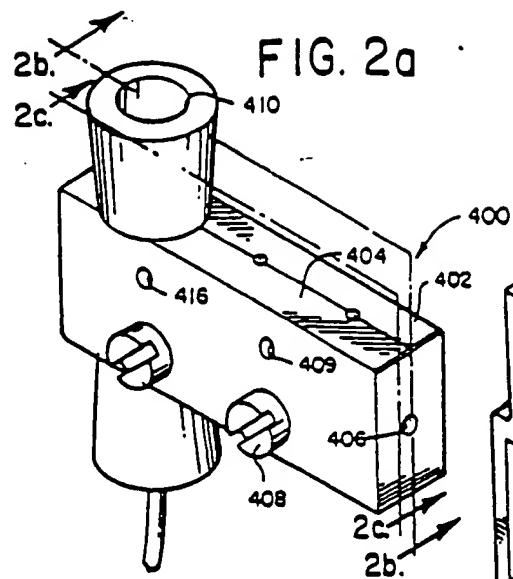


FIG. 3

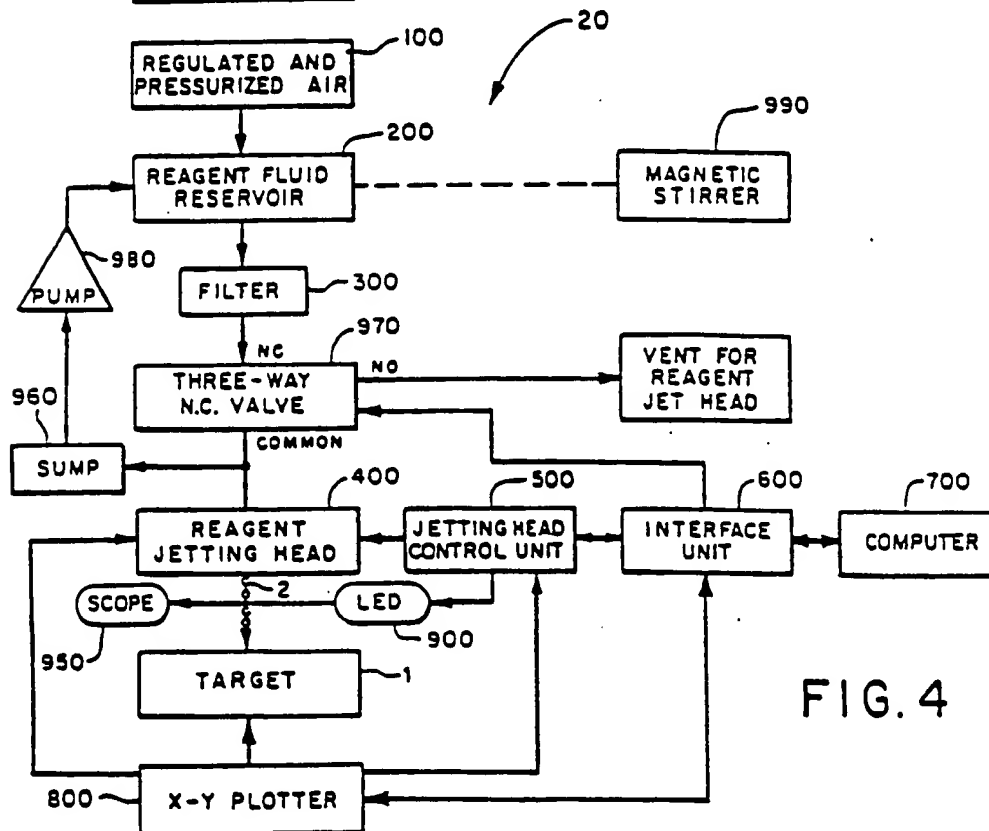
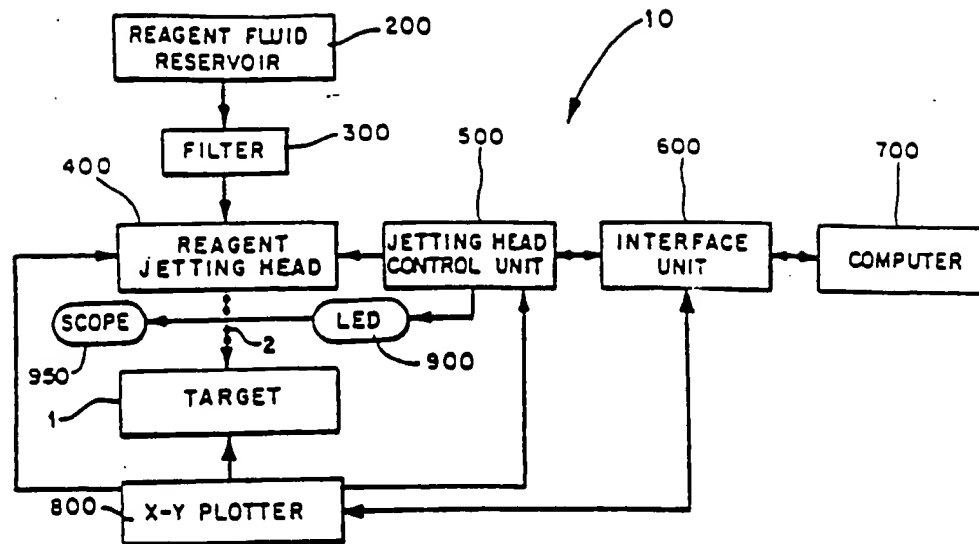


FIG. 4

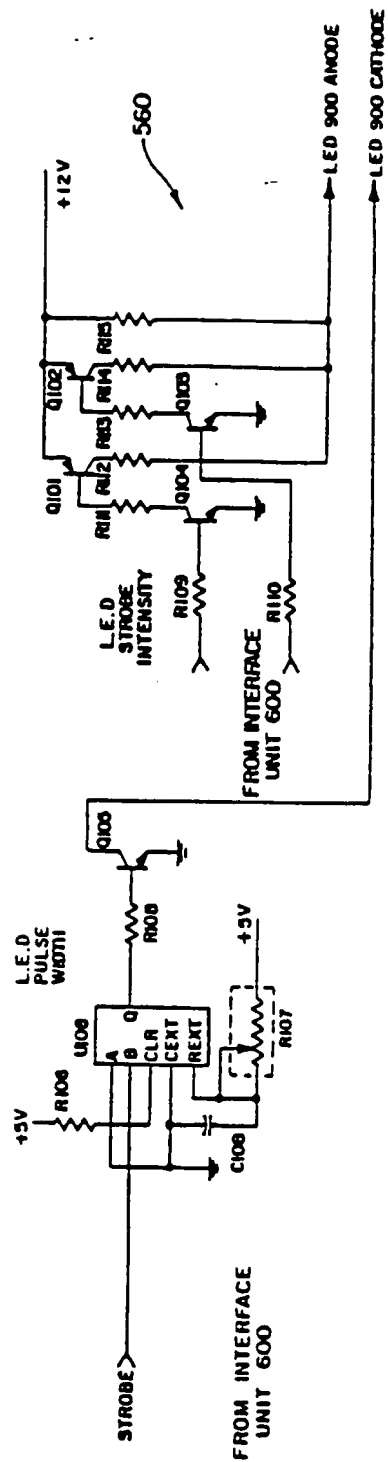


FIG. 5a

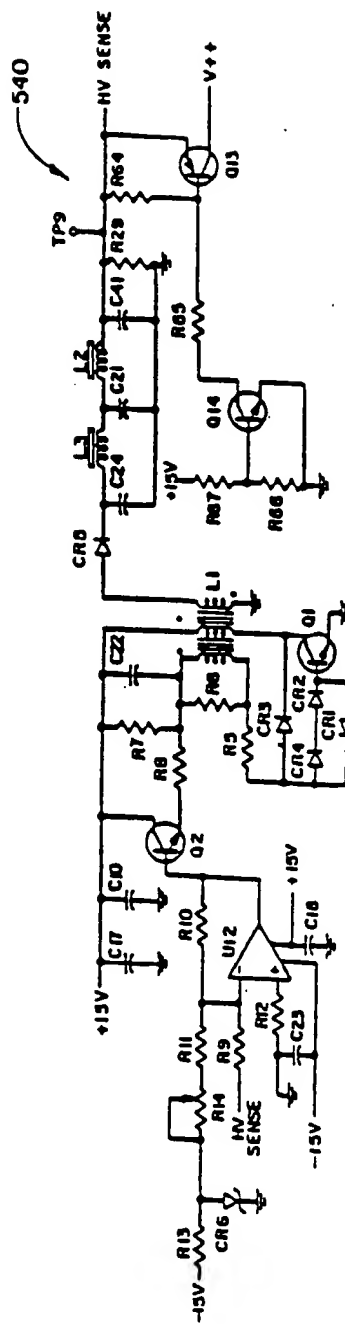


FIG. 5b

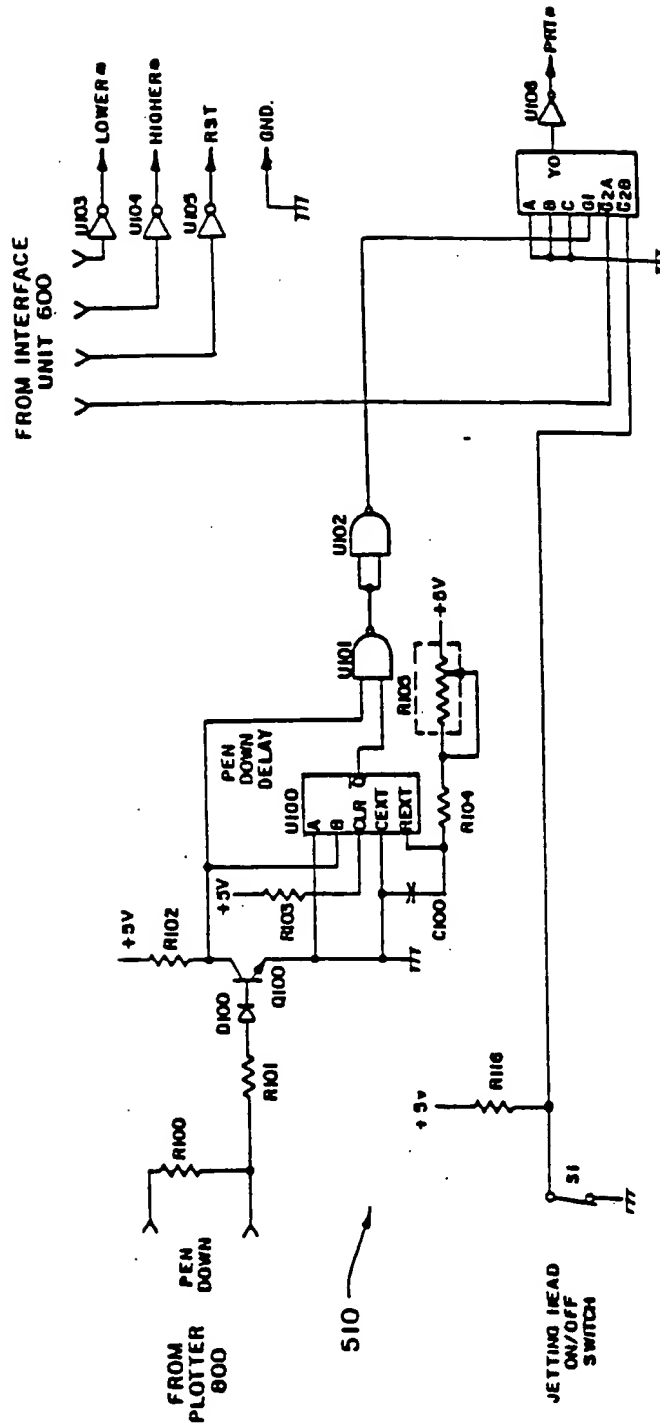


FIG. 5c

FIG. 5d

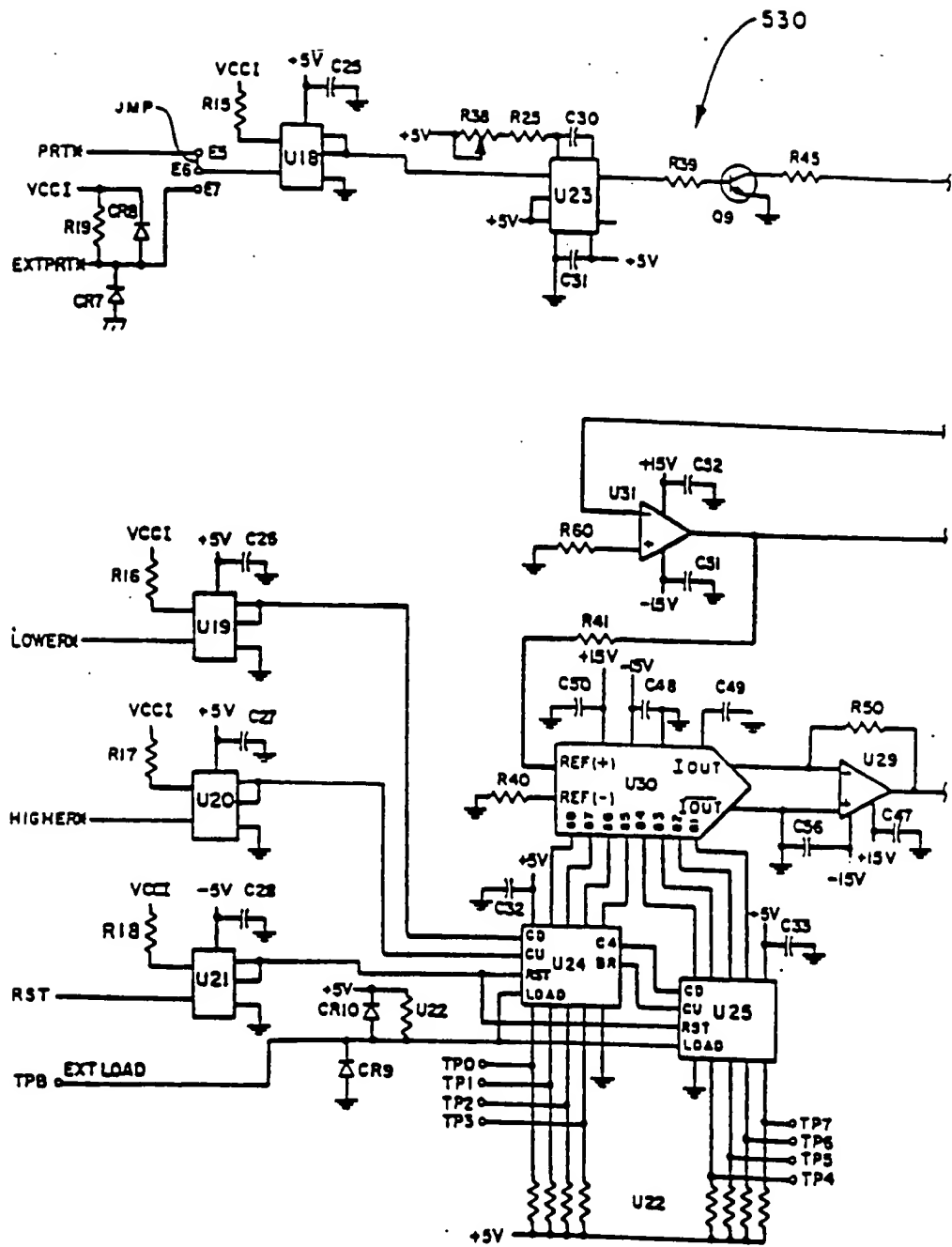


FIG. 5e

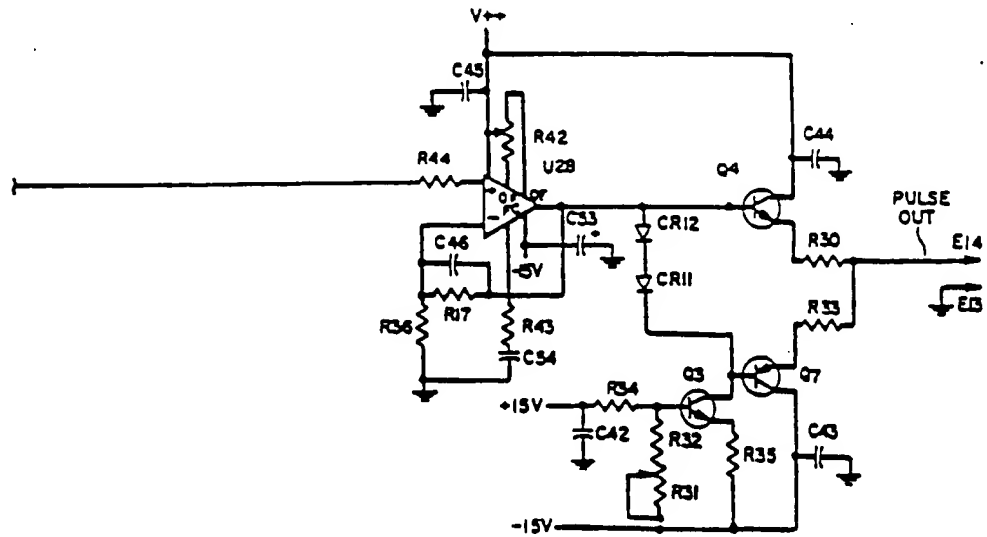
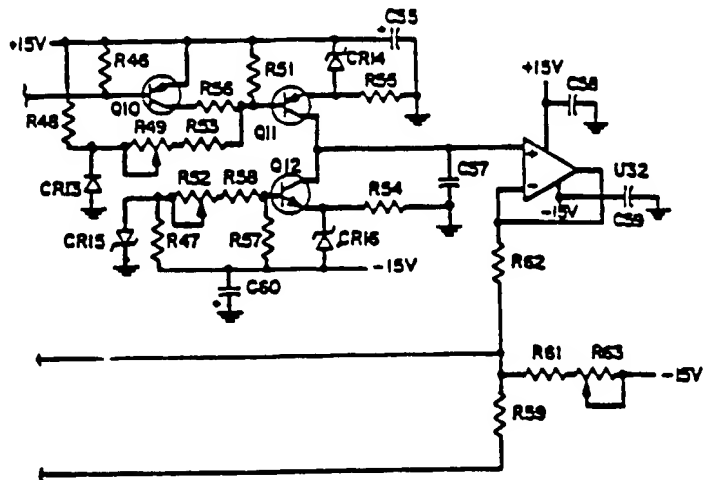


FIG. 6a

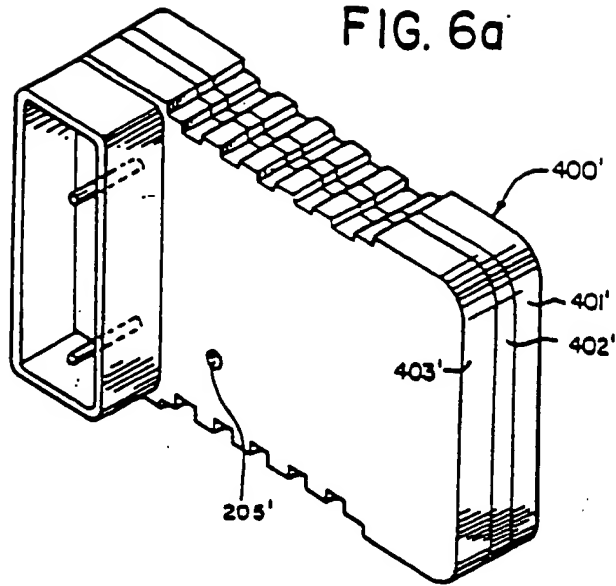


FIG. 7

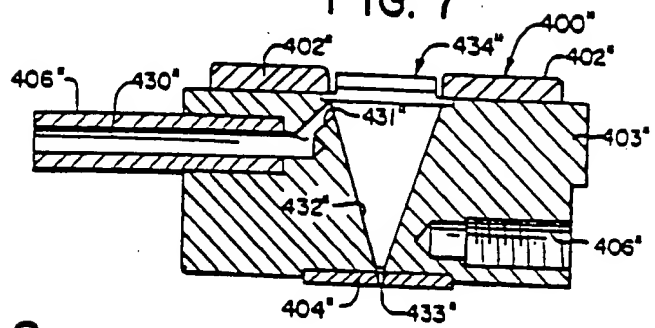
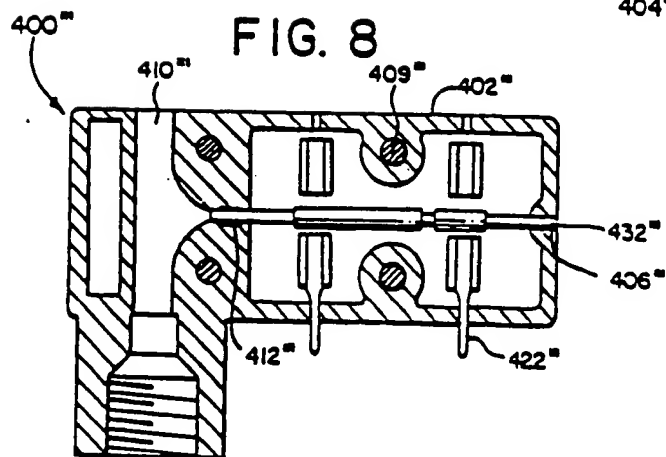
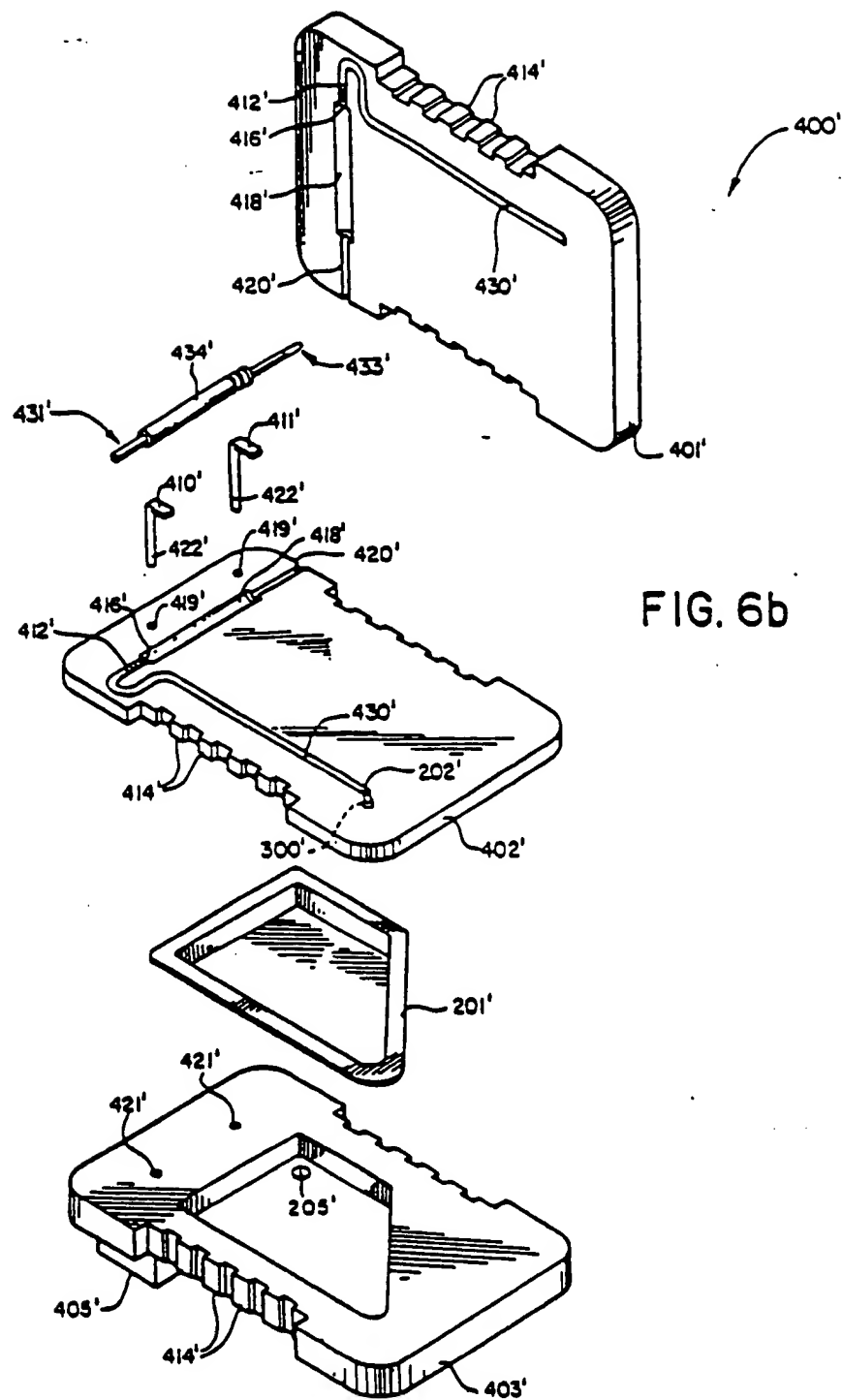


FIG. 8





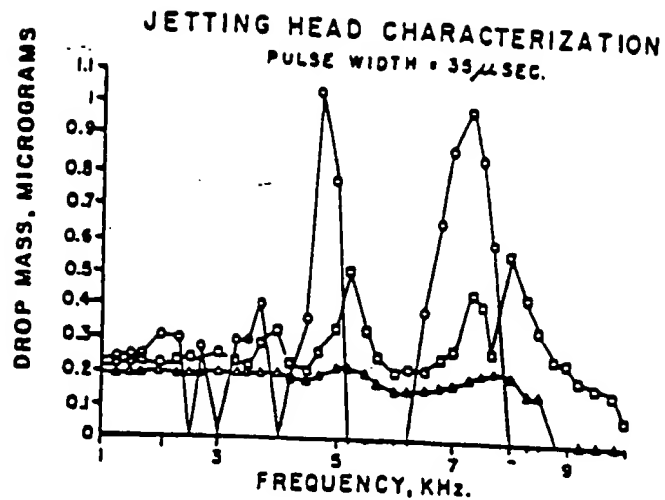


FIG. 9

□ VIS = 5CP
○ VIS = 1CP
△ VIS = 24CP

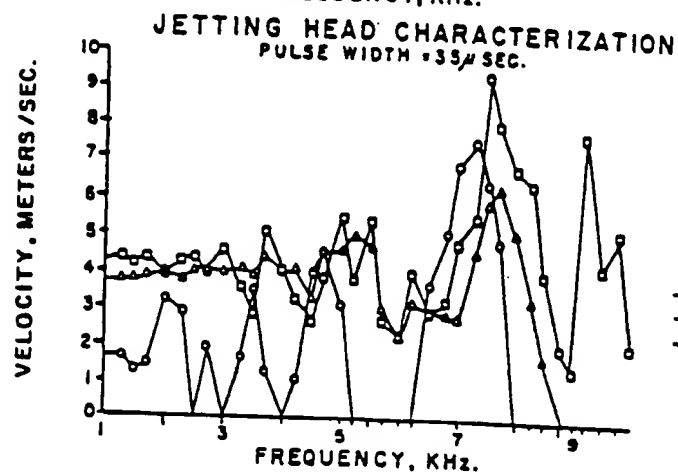


FIG. 10

□ VIS = 5CP
○ VIS = 1CP
△ VIS = 24CP

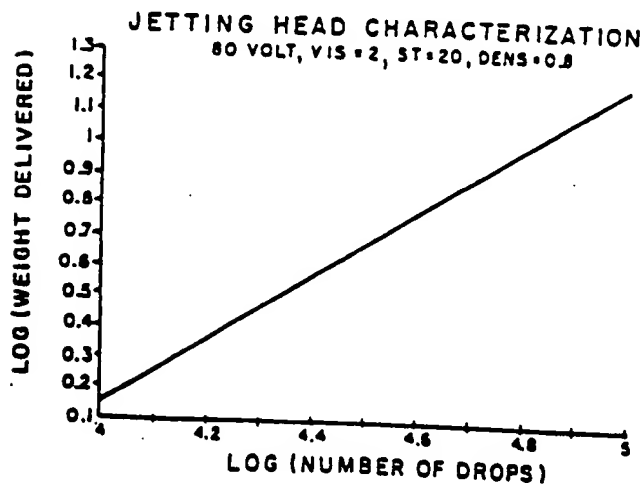


FIG. 11